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Thesis

THE RELATION OF AN UNDERSTANDING OF THE SITUATION INVOLVED IN A PROBLEM AND SUCCESS IN ITS SOLUTION

by

Helen Mildred White
(B. Ed., Brown University, 1929)

submitted in partial fulfilment of the

requirements for the degree of

Master of Arts

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Table of Contents

Page

I. Introduction 1

1. Aim and Importance of the Study 1

a. Aim of study
b. Importance of failure
economic aspect
personality aspect
c. Importance of failures in arithmetic
100% accuracy in fundamentals
failure in problem solving

2. Other indications of importance of the problem and the inadequacy of solutions offered 5

Work done by
Buswell
John
Morton
Banting
Osburn
Buckingham

3. Objectives in problem solving 9

Informational and computational arithmetic

a. Social usage of arithmetic
Wilson
Wise
b. Industrial usage
Louth
Sala

Relation of these studies to problem solving

4. Previous studies 11

Washburne and Osborne
Washburne and Morphett
Hydle and Clapp
Brownell and Stretch

II. Description of Experiment 15

1. Nature of Study 15

a. Paired problems, half within children's experience and half without (judgment of author later checked by questionnaire)

Page

b. Constant factors
processes
difficulty
common usage of figures involved

2. Selection of problems 15

a. Sources of processes selected
arithmetic text books
problems used by teachers in 6B grade
6B curriculum

b. Situations experienced by children
sources of information
frequencies of experiences

3. Material of study,--form of tests 26

a. Paired problems
four groups,--A, B, C, D.
comparison of paired problems for each group

b. Timing of problems
results in five-minute periods for four groups

c. Questionnaire
validity of questions

III. One Thousand Cases and Their Results 36

1. Giving of test and selection of one thousand cases 36

a. IQ's
questionnaire
correction of problem

b. Selection of one thousand cases
discards
IQ's below D
no IQ
unfinished tests
without questionnaire
forty-six at random

2. Tabulating 37

a. Tables for each problem tabulating results in one of twelve possible ways

Numbers and percentages for four IQ groups

b. Tables for each pair of matched problems

Page

Comparison of percentages for IQ groups as to
experience
right process
right answer

c. Tables for total percentages of groups irrespective of IQ

Comparison of percentages in problems based on experience and those based on non-experience as to
right process
right answer
errors in computation
wrong process
incomplete problems
omitted problems
indeterminate answers

d. Final table of total percentages of all problems irrespective of all groupings except as experienced or non-experienced.

Comparison as to
right process
right answer
errors in computation
wrong process
incomplete problems
omitted problems
indeterminate answers

e. Check on equality of difficulty of problems

3. Interpretations of these tables with summaries for each pair of matched problems, total groups of problems, and a final total. 43-159

Group A,--general summary 68
" B " " 95
" C " " 124
" D " " 150
Total group summary 155

IV. A More Critical Examination 160

1. Inequality of paired problems 161

a. As to computational difficulty
significance of differences in percentages

b. As to word statement

Page

2. Data from four selected problems 165

3. Significance of differences in percentages for twelve pairs of problems compared with significance of differences in percentages for four pairs of selected problems. 170

V. Conclusions and Implications for Education 173

1. Conclusions 173

a. From total percentages
b. From analysis of various groups and problems
c. Further possible factors involved

2. Implications for Education 177

Bibliography 180

Appendices 182

Appendix A
" B
" C
" D

List of Tables

Table		Page
I.	Comparison of Problems As To Difficulty As Shown By Number Correct When Given As Examples Without the Problem Situation.	42
	Group A,--Decimals	
II.	Tabulation of One Thousand Solutions for Problem 15 In Which the Situation Is Judged to be Experienced.	45
III.	Tabulation of One Thousand Solutions for Problem 10 In Which the Situation Is Judged to be Non-experienced.	46
IV.	Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 15 and 10.	47
V.	Total Numbers and Percentages for Problems 15 and 10 Irrespective of IQ Groups.	48
VI.	Tabulation of One Thousand Solutions for Problem 24 in which the Situation is Judged to be Experienced.	52
VII.	Tabulation of One Thousand Solutions for Problem 20 in which the Situation is Judged to be Non-experienced.	53
VIII.	Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 24 and 20.	54
IX.	Total Numbers and Percentages for Problems 24 and 20 Irrespective of IQ Groups.	55
X.	Tabulation of One Thousand Solutions for Problem 3 in which the Situation is Judged to be Experienced.	59
XI.	Tabulation of One Thousand Solutions for Problem 8 in which the Situation is Judged to be Non-experienced.	60
XII.	Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 3 and 8.	61
XIII.	Total Numbers and Percentages for Problems 3 and 8 Irrespective of IQ Groups.	62

List of Tables (continued)

Table		Page
XIV.	--Total Numbers and Percentages for Group A,--Decimals, Irrespective of Groupings Except as Based on Experienced and Non-experienced Situations.	67
	Group B,--Fractions	
XV.	--Tabulation of One Thousand Solutions for Problem 17 in which the Situation is Judged to be Experienced.	72
XVI.	--Tabulation of One Thousand Solutions for Problem 13 in which the Situation is Judged to be Non-experienced.	73
XVII.	--Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 17 and 13.	74
XVIII.	--Total Numbers and Percentages for Problems 17 and 13 Irrespective of IQ Groups.	75
XIX.	--Tabulation of One Thousand Solutions for Problem 21 in which the Situation is Judged to be Experienced.	80
XX.	--Tabulation of One Thousand Solutions for Problem 23 in which the Situation is Judged to be Non-experienced.	81
XXI.	--Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 21 and 23.	82
XXII.	--Total Numbers and Percentages for Problems 21 and 23 Irrespective of IQ Groups.	83
XXIII.	--Tabulation of One Thousand Solutions for Problem 6 in which the Situation is Judged to be Experienced.	87
XXIV.	--Tabulation of One Thousand Solutions for Problem 2 in which the Situation is Judged to be Non-experienced.	88
XXV.	--Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 6 and 2.	89
XXVI.	--Total Numbers and Percentages for Problems 6 and 2 Irrespective of IQ Groups.	90

List of Tables (continued)

Table		Page
XXVII.	--Total Numbers and Percentages for Group B,--Fractions, Irrespective of Groupings except as Based on Experienced and Non-experienced Situations.	94

Group C,--Denominate Numbers

XXVIII.	--Tabulation of One Thousand Solutions for Problem 18 in which the Situation is Judged to be Experienced.	99
XXIX.	--Tabulation of One Thousand Solutions for Problem 22 in which the Situation is Judged to be Non-experienced.	100
XXX.	--Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 18 and 22.	101
XXXI.	--Total Numbers and Percentages for Problems 18 and 22, Irrespective of IQ Groups.	102
XXXII.	--Tabulation of One Thousand Solutions for Problem 11 in which the Situation is Judged to be Experienced.	108
XXXIII.	--Tabulation of One Thousand Solutions for Problem 16 in which the Situation was Judged to be Non-experienced.	109
XXXIV.	--Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 11 and 16.	110
XXXV.	--Total Numbers and Percentages for Problems 11 and 16 Irrespective of IQ Groups.	111
XXXVI.	--Tabulation of One Thousand Solutions for Problem 14 in which the Situation is Judged to be Experienced.	116
XXXVII.	--Tabulation of One Thousand Solutions for Problem 19 in which the Situation is Judged to be Non-experienced.	117
XXXVIII.	--Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 14 and 19.	118
XXXIX.	--Total Numbers and Percentages for Problems 14 and 19 Irrespective of IQ Groups.	119

List of Tables (continued)

Table		Page
XL.	Total Numbers and Percentages for Group C,--Denominate Numbers, Irrespective of Groupings Except as Based on Experienced or Non-experienced Situations.	123
	Group D,--Easy Problems	
XLI.	Tabulation of One Thousand Solutions for Problem 1 in which the Situation was Judged to be Experienced.	128
XLII.	Tabulation of One Thousand Solutions for Problem 5 in which the Situation was Judged to be Non-experienced.	129
XLIII.	Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 1 and 5.	130
XLIV.	Total Numbers and Percentages for Problems 1 and 5 Irrespective of IQ Groups.	131
XLV.	Tabulation of One Thousand Solutions for Problem 9 in which the Situation is Judged to be Experienced.	135
XLVI.	Tabulation of One Thousand Solutions for Problem 7 in which the Situation is Judged to be Non-experienced.	136
XLVII.	Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 9 and 7.	137
XLVIII.	Total Numbers and Percentages for Problems 9 and 7 Irrespective of IQ Groups.	138
XLIX.	Tabulation of One Thousand Solutions for Problem 4 in which the Situation is Judged to be Experienced.	142
L.	Tabulation of One Thousand Solutions for Problem 12 in which the Situation is Judged to be Non-experienced.	143
LI.	Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 4 and 12.	144
LII.	Total Numbers and Percentages for Problems 4 and 12 Irrespective of IQ Groups.	145

List of Tables (continued)

Table		Page
LIII.	Total Numbers and Percentages for Group D,--Easy Problems, Irrespective of Groupings Except as Based on Experienced and Non-experienced Situations.	148
	Total Groups	
LIV.	Total Numbers and Percentages for the Twenty-four Thousand Solutions given to Twenty-four Problems, Twelve of which are Based on Experienced Situations, and Twelve of which are Based on Non-experienced Situations.	153
	Tables for Critical Evaluation	
LV.	Significance of the Differences Between the Percentages of Correct Solutions for Computation Involved in Twelve Matched Pairs of Problems as Found in Table I.	161
LVI.	Significance of the Differences in Percentages for Pair 1, Problems 1 and 5.	165
LVII.	Significance of the Differences in Percentages for Pair 11, Problems 24 and 20.	166
LVIII.	Significance of the Differences in Percentages for Pair 4, Problems 4 and 12.	167
LIX.	Significance of the Differences in Percentages for Pair 12, Problems 21 and 23.	168
LX.	Significance of the Differences Between the Percentages for Problems Based on Experienced Situations and Those for Problems Based on Non-experienced Situations, as Found in Table LIII.	171
LXI.	Significance of the Differences in Percentages for the Selected Group of Eight Problems, Four of Which are Based on Experienced Situations and Four of Which are Based on Non-experienced Situations.	172

THE RELATION OF AN UNDERSTANDING OF THE SITUATION INVOLVED IN A PROBLEM AND SUCCESS IN ITS SOLUTION

Part I.

Introduction

I. Aim and Importance of Study.

This study is concerned with the failure of children in problem solving. The experiment described in the following pages is based on the theory that some relationship may exist between the understanding of the situation involved in the problem and success in its solution. It is desirable to throw light upon the question as to whether in problem solving there is less confusion on the part of the child when the situation involved in the problem is within his experience.

All failure in school is important. It is worthy of investigation because of its social and economic aspect as well as its effect upon the mental life of the individual child. Dickson[1] makes the statement that about two million, or ten per cent of the children enrolled in the elementary schools fail each year. He quotes the annual cost of education per pupil in the elementary grades as at least forty dollars, and the annual cost of re-teaching those who fail each year in the United States at least eighty million dollars. Elliot[2] says, "Every pupil failure costs the taxpaying public from sixty dollars to one hundred sixty dollars in re-educational costs." Such failures are a challenge to us not only on the economic side, for every failure adds to the financial cost, but also on the human side.

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[1] V. E. Dickson, Mental Tests and the Classroom Teacher, pp. 129, 130.

[2] Supt. Elliot, Mount Vernon, Ohio; School Executives Magazine, September 1931.

The social and mental aspect is as serious. Failure may so discourage and embitter a child as to change his personality and his whole attitude toward school. There is a cumulative aspect to failure which results in less and less effort on the part of the child as he becomes more and more of a failure. Leavitt[1] believes that the child's disinclination to continue in the face of defeat and confusion is fundamentally correct behavior from the standpoint of the individual. He says that the remedy is readjustment of conditions and methods. Since problems embody the application of the facts of arithmetic to experiences in life, it is important that children should not experience continual failure in this respect. Experiment and research may show us where we err. Burnham[2] says, "Apparently in all civilized countries, at least in England and America, a large percentage of the pupils have the continued experience of failure. . . . This is not a mere matter of formal education; but success is one of the simple conditions of mental health, largely neglected, probably because it is so commonplace and so familiar to everybody. . . . Extended investigations have shown an appalling number of failures in our schools. . . . The money cost of repeaters is serious but far worse is the loss in human values, because for many of these children this means failure day after day and week after week."

That arithmetic plays a large part in this failure is stated in many investigations. Brueckner[3] says, "Surveys of instruction have

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[1] R. G. Leavitt, Educational Review, 75; pp. 281-286; May 1928.

[2] W. H. Burnham, The Normal Mind, p. 456.

[3] L. J. Brueckner, Diagnostic and Remedial Teaching in Arithmetic, p. 1.

shown that one of the chief causes of non-promotion in the elementary school is failure in the subject of arithmetic." Corning[1] says, "Because of the accuracy required and the reasoning involved, arithmetic has probably caused more fatalities than any other subject taught in our schools." Buswell[2] in the Twenty-ninth Year Book notes that several psychological studies have emphasized the difficulty of the arithmetic operations showing that arithmetic causes more failure than any other subject in the elementary school.

A major function of arithmetic is to enable the child to apply his knowledge of numbers to situations when the need arises. This involves a knowledge of fundamental processes and an ability to apply that knowledge. That failure in fundamental processes is unnecessary has been shown by many studies. One hundred per cent accuracy has been made possible by omitting useless processes, and developing a definite teaching plan with proper drill service. Wilson[3] in the National Education Journal for June 1931, shows an example of a definite teaching plan and drill service for the process of addition. Other processes in fundamentals are also worked out. In "100% Accuracy,"[4], Wilson gives seven steps whereby this can be achieved provided the drill is carried out as directed. In the Journal of Educational Research, December, 1930,[5] he gives an account of an experiment tried to see if with a simplified program it was possible to approach letter perfect results in addition and subtraction by the close of the third grade. The drill service was based on systematic procedure, regular check-up

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[1] H. M. Corning, After Testing, What? p. 82.
[2] G. T. Buswell, Twenty-ninth Yearbook, National Society of Education, Chap. 3, p. 451.
[3] G. M. Wilson, National Education Journal, June 1931, pp. 221-222.
[4] G. M. Wilson, 100% Accuracy in Arithmetic.
[5] G. M. Wilson, Journal of Educational Research, December 1930, vol. 22; pp. 351-360.

and the final aim of letter perfect results. Third grade results showed that eighty-two per cent of the children were letter perfect in addition and seventy-two per cent in subtraction. Margaret Sweeney[1] carried on an experiment in checking the accuracy of long division with fifth and sixth grade children. The Wilson Process Inventory and Diagnostic Tests of Long Division were used. The results were listed as one hundred per cent or failure. Mastery of subtraction and multiplication as involved in long division was checked. Short division mastery was checked and worked on for one hundred per cent accuracy. The children kept records. Two trials were given, one in October and one in March. The latter test showed a large increase in one hundred per cent accuracy.

We must conclude from many such studies that we can approach one hundred per cent accuracy in fundamentals. The next step is the application of knowledge of fundamentals to arithmetic problems. The ability to apply the knowledge of fundamental processes to the solution of problems is another matter. Here there is much confusion and failure. The house has not been cleaned and set in order as yet. Morton[2] acknowledges that teaching children to solve problems is one of the most difficult tasks which the elementary teacher has to perform. He says, "It must be admitted that no one knows just what kinds of problems constitute the best instructional material or what techniques are most successful for pupils of various intelligence levels. Much research remains to be done before we shall know just how to teach children to solve problems." That it is a matter of importance is shown by the variety of efforts that are being made to supply a remedy. Men of

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[1] Margaret Sweeney, Boston University Thesis, 1926. M. Ed.

[2] R. L. Morton, Teaching Arithmetic in Intermediate Grades, p. 234.

note have spent time, energy, and thought on the solution of this problem of "problems," and still we appear to be only temperizing and building with artificial aids, taking the temperature rather than looking at the infection.

II. Solutions Offered and Some Inadequacies.

Buswell and John[1] make this statement: "The failures due to arithmetic are to be traced to three conditioning factors, namely, (1) the materials of arithmetic, consisting of textbooks, practice exercises, and special devices; (2) the teacher's methods of instruction and her manner of presenting arithmetic to the pupils; and (3) the methods and mental processes of the pupils." Their monograph deals with the fundamental processes and is a study of the third factor involved. These three factors might also apply to problems and it must be conceded that many of the careful investigations of problem difficulties have also dealt with this third factor. Comparatively little attention has been paid to the theory that the material of problems should be within the child's experience. Lenore John[1] analyzes types and frequencies of errors in problem solving and lists them under errors in reasoning, in fundamentals, in reading, and miscellaneous errors. Out of 698 errors in problem solving, she finds the highest frequency to be in reasoning. She lists them as follows:

Reasoning	383
Fundamentals	160
Reading	86
Miscellaneous	69
Total	698

[1] G. T. Buswell and Lenore John, Diagnostic Studies in Arithmetic, p. 1.

[2] Lenore John, Elementary School Journal, 31; pp. 202-218. Nov., 1930.

Under reasoning she lists eighteen types of errors. They include such types as confusion of quantities, confusion of numbers, confusion of method, wrong process, disregard of significant factors in the problem, disregard of facts to be supplied, and so on. Six types of errors in fundamentals involved in problems include such errors as failure to attempt multiplication or division, inability to interpret fraction, attempt to subtract three numbers. Ten types of miscellaneous errors include failure to attempt the problem, giving up the problem, failure to appreciate the absurdity of the answer. Among the six types of errors in reading problems, she lists one which is significant from the standpoint of the present study, viz., obvious misunderstanding of the situation.

Morton[1] analyzes errors in problem solving into eight classes. These are listed as

1.	Procedure wholly wrong or entirely inadequate	57.8%
2.	Procedure partly wrong	7.7%
3.	Inadequate knowledge of processes involved	5.9%
4.	Procedure correct so far as carried out, but incomplete	6.6%
5.	Errors in computation	14.9%
6.	Errors in copying figures or words	4.7%
7.	Lack or knowledge of facts	0.5%
8.	Unknown	1.0%

Types "6" and "8" are of minor percentage and importance as diagnostic of problem solving difficulty. Types "3" and "5" are concerned basically with better knowledge of fundamental facts and processes and so are re-

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[1]R. L. Morton, Teaching Arithmetic in Intermediate Grades, pp. 312-317.

lated more directly to one hundred per cent accuracy in fundamentals, and indirectly to problem solving. Type "1," which includes over half of the errors, and types "2," "4," and "7" are concerned directly with the problem solution. The present study is concerned with the possibility that when the problem situation is within the understanding of the child, many confusions which result in wrong procedures, either in whole or in part, incomplete solutions, and lack of knowledge of facts involved in the situation, will not occur.

Thorndike[1] selects three main elements in problem solving: (1) to know just what the question is, (2) to know what facts you are to use to answer it, (3) to use them in the right relation. He says, "When the actual situation is present, and itself defines the question, there is likely to be almost no difficulty in respect to the first of these three, and relatively little in respect to the others."

Banting[2] has made a careful study of causes of failure in solving simple problems. He lists fourteen causes. Among them are such causes as failure to comprehend the problem in whole or in part, and inability on the part of the pupil to do reflective thinking. These appear to be blanket terms and Banting does interpret the first into four subheads, the last of which is, in our opinion, the most vital--namely, lack of necessary experience to reproduce mentally the concrete situation of the problem. Such causes as lack of ability to identify proper processes, lack of interest in the problem, focusing on the numbers involved rather than on the situation, being guided (or misguided) by verbal signs instead of analyzing the problem, are

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[1] E. L. Thorndike, The New Methods in Arithmetic, pp. 126-127.

[2] G. D. Banting, Second Year Book National Education Association, Dept. El, School Principals, pp. 411-421.

other causes which we believe may be closely allied to the lack of understanding of the situation involved.

Morton[1] makes the statement that over sixty-six per cent of errors are due to failure to understand the significance of what a problem is about. To counteract this lack of understanding we find many suggestions as to artificial aids. The child should ask himself, "What am I to find out? What am I asked? What shall I do with these numbers?" Osburn[2] advocates the learning of cues which tell what to do. Teaching a few cues well, training the child to see similiarities and identical elements are supposed to help in the solution of problems. Is it not possible that this is simply scratching at the surface of the matter while we continue to give to children problems which are beyond their experience?

Ruth Cameron[3] has made an analysis of the Osburn, Buckingham Arithmetics, Books 1, 2, 3, and 4. She separates the problems into real situations, life situations, unified situations, and isolated situations. Real situations arise from a felt need in the school room, work shop, or home. She finds no real situations given in these texts. Life situations she describes as a play-like situation closely allied to a real situation. There are no life situations in these texts. Unified situations are made from isolated problems brought under one head. She finds twenty-five unitied situations in which there are 350 problems and 293 situations. Isolated problems are composed of unrelated experiences, with no attempt to build up the child's understanding or relate the work to the community's needs. In analyzing the

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[1] E. L. Morton, University of Ohio Research Bulletin, April 15, 1929, May 13, 1925.

[2] Worth Osburn, Corrective Arithmetic, Vol. II, Chap. 2.

[3] Ruth Cameron, Boston University Seminar Paper, 1923, B. S. in Education.

isolated problems she finds 2,339 situations, involving over 6,000 isolated problems. Are we sensible when we expect children of elementary grade age to grasp so enormous a range of situations?

All these studies and methods have gone far in analyzing types of failure in problems as they occur in the classroom and in offering props for the teaching of these problems. Do we not, however, need to be more basic even than this in our thinking, and require problem thinking in situations within the child's experience where artificial props and cues will not be needed? Wilson[1] reviews in Educational Method much of the work done on written problems and notes that the "big revelation that two-thirds of all errors occur because the children do not know what it is all about has, as yet, found no solution in textbook form."

III. Objectives in Problem Solving.

Many studies have been made which show that the arithmetic needed on the basis of use in society is limited and much more simple than is found in many arithmetic textbooks. Woody[2] made a study of the use of numbers in selling goods in department stores. Wilson[3] has analyzed arithmetical processes in their relation to social usage. Wise[4] made the same kind of a survey in another section of the country and arrived at practically the same conclusions. Charters, as quoted in "What Arithmetic Shall We Teach?"[5] shows a surprising simplicity of arithmetical operations in his study of department store arithmetic.

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[1] G. M. Wilson, Educational Method, November 1931, p. 68.

[2] Clifford Woody, Third Year Book, Department of Superintendence, National Education Association, 1925, pp. 50-53.

[3] G. M. Wilson, A Survey of the Social and Business Usage of Arithmetic.

[4] C. T. Wise, Elementary School Journal, October 1919, p. 118.

[5] G. M. Wilson, What Arithmetic Shall We Teach?

Recently two further studies have been made simultaneously, of the use of denominate numbers in industries. One was made in Providence, Rhode Island[1] and the other in New Britain, Connecticut[2]. It is not our purpose to summarize these studies. In general they limit computational arithmetic both as to content and difficulty. Wilson[3] sums up the results in the following paragraph. "If, to the four fundamental processes and fractions we were to add accounts, simple denominate numbers, and percentage, little is left for all other processes--so little in fact that it seems unfair to give time and attention to them as drill processes in the elementary schools. Some of them should receive no time or attention, others should receive attention only for informational purposes . . . . or when found necessary in the development of a large motivated situation." The two theses on measurements in industry tend to show that it is not profitable for children in the elementary grades to spend time committing to memory tables of measures. When a pupil understands the commodity involved it is not difficult for him to apply the preferred unit of measurement to that commodity. The teaching of addition, subtraction, multiplication, and division of compound denominate numbers has little value, and reduction ascending and descending has no value in industry with the exception of the estimating departments.

We can hardly refuse to accept this mass of data from the social and industrial world. If in the adult world the actual use of arithmetic is so simplified in its application, how can we expect children

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[1] Mary deS. Louth, Units of Measurement in Industry, Boston University Thesis, 1931.

[2] V. Sala, Denominate Numbers Used in Factories in New Britain, Boston University, 1931.

[3] G. M. Wilson, What Arithmetic Shall We Teach?

to succeed in solving verbal problems describing situations more complicated than even the adult meets, to say nothing of its being far beyond the experience and understanding of the child? It is not surprising that it is necessary to devise props, cues, and remedies for forty or more types of errors in the array of problems set before the child. Is it not logical to believe that his failure may be, to a large degree, tied up with his lack of experience in and understanding of the situation involved in the problem itself? Do we as adults ever figure on situations which we do not understand? Why, then, should we expect this of children?

IV. Previous Studies.

This question has already presented itself as of enough importance to warrant investigation. Several studies have been made in a variety of ways. Washburne and Osborne[1] in studying problem solving find that giving children many problems to solve takes precedence as a method over training to see analogies between difficult written problems and simple oral ones, which in turn takes precedence over training children to analyze problems according to a technique presented. They find that familiarity of setting has some influence on success and conclude that many problems with familiar situations should be given rather than training in analogies or formal technique.

Washburne and Morphett[2] carried on an experiment with fifth grade children as to unfamiliar situations as a difficulty in solving arithmetic problems. Matched pairs of problems involving the same computation were given to 441 children. They found a high percentage

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[1] C. W. Washburne and R. Osborne, Elementary School Journal 27, pp. 219-226, pp. 296-304.

[2] C. W. Washburne and Mabel V. Morphett, Journal of Educational Research 18, October 1928, pp. 220-224.

of correct solutions in the familiar situations which leads them to conclude that there is a strong effect of familiar and unfamiliar elements in problem solving.

Hydle and Clapp[1] made a study of the "Elements of Difficulty in the Interpretation of Concrete Problems in Arithmetic. . . . This is an elaborate experiment tried out in grades four to eight, involving 300,000 solutions, and eight elements of difficulty which affect the solution of the problem. They conclude that the nature of the situation as to familiarity has but little significance as a factor in problem solving. They stress ability to visualize a situation. While this study is elaborate it does not seem to us to be very fine. Problems were scored only as to correctness of answer, and no attempt was made to differentiate between various types of wrong answers.

A very recent study has been made by Brownell and Stretch[2]. They believe that the varying results of the studies already mentioned may be due partially to varying techniques and inadequacies, and partially to the fact that possibly several factors are involved in the influence of unfamiliar settings. In their own study they have made a very careful attempt to equalize the matched problems. Four problems were used and varied four times for degrees of familiarity. These variations of each original problem used the same numbers, the same arithmetical operations, the same clues, the same number of words, and the same kind of sentence structure.

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[1] Hydle and Clapp, Elements of Difficulty in the Interpretation of Concrete Problems in Arithmetic, Bureau of Educational Research Bulletin, No. 9, University of Wisconsin, 1927.

[2] W. A. Brownell and Lorena Stretch, The Effect of Unfamiliar Setting on Problem Solving, Duke University Research Studies in Education, No. 1, Duke University Press, 1931.

They find it impossible to give an absolute answer regarding the influence of unfamiliar settings on problem solving. They imply that unfamiliar settings may interfere with choice of process or with computation. They believe that their data offers no ground for reasonable belief that problems are made unduly difficult for children by being given unfamiliar settings, except under certain circumstances. These circumstances include the difficulty of the problem itself, the number of times the child has dealt with a given number relationship, and the amount of time it takes to solve a problem.

These conclusions are in our opinion somewhat invalidated by the small number of problems involved and the fact that the experiment was tried with only 256 children. Our greatest criticism, however, is the basis for defining a situation as familiar. No study was made of children's activities upon which to base the judgment of the situation as familiar or unfamiliar. The problems were rated by teachers as to familiarity and not by pupils. While the verbal setting represents less familiarity in each variation of a given problem, we do not believe that the familiarity and experience in a situation is wholly represented by verbal setting alone. The first example is one of finding an average. This finds its variations in school marks, eggs laid by a hen, baskets of tea leaves dried, and brets of graks collected. The objects involved certainly vary in familiarity but the essential situation involved is that of averaging and it is our experience that this situation is not a familiar experience to children except as they are taught in the classroom and that this teaching sinks into oblivion unless

really experienced by the child. In a study of frequencies of children's activities reported later in this experiment, we find that with seventy-nine children only five reported finding average distance as an experience, and only six reported finding average time as an experience. In one of these classrooms no one reported finding average time as an experience. In one of these classrooms no one reported either as an experience , and the teacher said, "Oh yes, children, don't you remember we were finding average time two weeks ago?" It is significant that in spite of performing this operation so recently, the children, with keener intuition, felt that they had not experienced it. It would seem necessary therefore to discriminate between truly experienced situations and those in which the situation involves familiar objects only.

Brownell and Stretch's study is valuable and their conclusion that the question is not an entirely simple one but involves complicated factors can be accepted. But their conclusions as to the effect of familiarity upon problem solving cannot be regarded as valid unless we regard the situations involved in the problems as truly experienced or non-experienced ones. The study at least points the way for further work and investigation, and inasmuch as our own experiment has made use of a different basis for the criteria of experience, a large number of cases, some variety of tabulation of answers, and the factor of intelligence, it is submitted in the hope that additional light may be thrown upon a subject so greatly in need of clarification.

PART II.

Description of the Experiment

I. Nature of Study

The experiment concerning the relation between the understanding of the situation involved in the problem and success in its solution was carried on in the 6B grade in the public schools of the city of Providence. The enrollment for this grade on October 1, 1931 was 1,860 pupils. It was decided to give to the pupils in this grade a series of paired problems in arithmetic, half of which should be within the experience of the majority of children and half of which should be without the experience of the majority of children as nearly as good judgment could determine this in advance. In an attempt to keep other factors constant it was necessary to select matched problems of equal difficulty in so far as possible, the processes involved were to be those with which 6B children were familiar in their grade work, and the numbers, fractions, or decimals used were to be equal from the standpoint of common use for both sets of problems. This narrowed the experiment down in so far as possible to the experimental factor, viz., the effect of the familiarity of the situation in problems upon ability to solve the problems.

II. Selection of Problems.

A large selection of problems was first made from two sources. Arithmetic textbooks were used and supplementary problems given by teachers in the 6B grades in Providence were collected. The textbooks used were The Modern School Arithmetic[1] which is the arith-

[1] Clark, Otis, Hatton, Modern School Arithmetic, Book Two.

metic upon which the curriculum of the 6B grade in arithmetic in the Providence public schools is based, Arithmetic Essentials[1], and the Iroquois Arithmetics[2]. In order to have a series of problems showing the processes and difficulty of the work as actually carried on in the first quarter of the 6B grade, a request was sent out to all 6B teachers to send in ten supplementary problems which they might use during this time. From over two hundred problems which came in from the teachers and from the sixth grade problems in the textbooks, it was decided to use mainly problems in fractions, decimals, and some measurements. In this grade common fractions are reviewed, the study of decimals is extended to include division and decimals of six places, and simple percentage is taught as a business application of simple fractions and of hundredths in decimals. Business forms, bills, and receipts are introduced. Graphs, banking, fundamental processes with denominate numbers, and volume are introduced. Some of these were omitted because it was impossible to pair them with equal problems within the child's experience and others because the children would not have become familiar enough with them before the end of the first quarter to be able to rule out difficulty as a factor in failure.

As an aid in choosing problems with familiar situations, a check was made on the experiences which children really have that involve problems in arithmetic. To get this, a number of organizations which are concerned with children's activities were interviewed. These included the Y. M. C. A., the Y. W. C. A., Headquarters of the Boy Scouts, Headquarters of the Girl Scouts, Jewish Com-

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[1] Drushel, Noonan, Withers, Arithmetic Essentials, Grade Six.

[2] De Groat, Firman, Smith, Iroquois Arithmetics, Book Two.

munity Center, Federal Hill House, (a settlement house in an Italian district) Nickerson House, (another settlement house in an Italian district) Junior Achievement Clubs, and the physical education and home economics departments of the public schools in Providence.

The data concerning children's activities gathered from these sources was listed under main headings such as earning money, buying food, paying dues, saving money, measuring, cooking, listing, handicraft, etc. These lists were taken into two sixth grade rooms, one in a foreign district and one in a middle class American section. The children were told that they could help us a great deal by answering some questions telling us how many of them did or did not do certain things. It made no difference to us whether they answered "yes" or "no" but we were very anxious to know whether children did or did not do the things we asked about. On the following pages are listed the results as gathered from the two rooms. A composite of the two rooms follow, and a list of the situations found to be most common. It is upon this final list that our problems involving situations within the child's experience are based.

Experiences Checked for Frequency

6B Room in Middle Class American District

Enrolled: Boys, 18; Girls, 20; Total, 38.

Experiences	Number of Pupils Answering "Yes"
Earning Money	35
washing dishes	8 (earn 10¢ to 25¢ a week)
cleaning	10
running errands	35
caring for babies	12 (6 boys, 6 girls)
shoveling snow	12 (9 " 3 ")
selling magazines	6 (boys)
piling wood	3 (")
paper route	1 (boy)
entertainments	35
buying and re-selling	4 (boys)
selling	
candy	12 (boys)
food	0
toys made	10 (8 boys, 2 girls)
Buying Food	38
Buying Materials for	
toys	16 (boys)
clothes	23 (5 boys, 18 girls)
Paying Dues for Club	30
Saving Money	
school bank	38
home bank	5
11 children had allowances 10¢ to 25¢	
Measuring	
weight	38
comparison as to loss or gain	26
height	36
potato race	25 (17 boys, 8 girls)
50 yd. dash	14 (12 " 2 ")
100 yd. dash	7 (")
broad jump	18 (14 " 4 ")
high jump	18 (14 " 4 ")
20 yd. swim	18 (12 " 6 ")
40 " "	7 (")
ball throw	36
6 boys had measured distance	

Experiences Checked for Frequency (continued)

Experiences	Number of Pupils Answering "Yes"
Cooking	37
candy	30 (10 boys, 20 girls)
cookies	6 (girls)
cake	12 (1 boy, 11 girls)
a meal	12 (2 boys, 10 girls)
Lists	36
money spent	36
add it up	36
Christmas list	28
look to see where they can get it cheaper	26
keep list of amounts bought	12 (girls)
list of food for a meal	5 (")
shopping list	12
Fishing	30 (18 boys, 12 girls)
Skating	36
Baseball	35 (18 boys, 17 girls)
Swimming	38
swimming pool	15 (boys)
Handicraft	27
toys	18 (16 boys, 2 girls)
clothes	8 (girls)
leather (sling shot, moccasin, card case, gun case)	18 (12 boys, 6 girls)
metal	5 (boys)
basketry	6 (girls)
towels	16 (")
hooked rugs	2 (")
embroidery	18 (")
Planning	
map for hike	23
price for food	12
quantities for food	4 (girls)
reckoning mileage	35
reading speedometer	38
average distance	5
average time	6
amount of time	
studying	0
walking	8
riding	30

Experiences Checked for Frequency

6B Room in Foreign (Italian) District

Enrolled: Boys, 18; Girls, 23, Total, 41.

Experiences	Number of Pupils Answering "Yes"
Earning Money	41
washing dishes	38
cleaning	28
running errands	41
caring for babies	18 (6 boys, 12 girls)
shoveling snow	15 (14 " 1 ")
selling magazines	11 (boys)
piling wood	6 (5 boys, 1 girl)
paper route	4 (boys)
entertainments	20 (12 boys, 8 girls)
buying and reselling	1 (boy)
selling	
candy	2 (boys)
food	1 (girl)
toys made	2 (boys)
Buying Food	41
Buying Materials for	
toys	12 (boys)
clothes	8 (girls)
Paying Dues for Club	13 (7 boys, 6 girls)
Saving Money	41
school bank book	41
Measuring	41
weight	41
comparison as to loss and gain	20
height	25
potato race	18 (12 boys, 6 girls)
50 yd. dash	30
100 yd. dash	28
broad jump	15 (boys)
high jump	12 (")
20 yd. swim	8 (boys)
40 yd. swim	0
ball throw	38
10 boys had measured distance	
Cooking	41
candy	35 (12 boys, 23 girls)
cookies	20 (2 " 18 ")
cake	18 (girls)
a meal	18 (2 boys, 16 girls)

Experiences Checked for Frequency (continued)

Experiences	Number of Pupils Answering "Yes"
Lists	40
money spent	40
add it up	30
Christmas list	40
look to see where they can get it cheaper	40
keep list of amounts bought	15 (5 boys, 10 girls)
list of food for a meal	3 (girls)
shopping list	30
Fishing	28 (22 boys, 6 girls)
Skating	30
Baseball	27 (20 boys, 7 girls)
Swimming	15 (12 boys, 3 girls)
swimming pool	12 (boys)
Handicraft	18
toys	18 (boys)
clothes	12 (girls)
leather (gun cases)	12 (boys)
metal (paper cutter)	4 (boys)
basketry	16 (girls)
towels	8 (girls)
hooked rugs	2 (girls)
embroidery	18 (girls)
Planning	
map for hike	4
price of food	8
quantities of food	12 (9 boys, 3 girls)
reckoning mileage	23
reading speedometer	18
average distance	0
average time	0
amount of time	
studying	2
walking	10
riding	20

Summary of Frequencies for Two 6B Rooms

Enrolled: Boys, 36; Girls, 43; Total, 79.

Experiences	Number of Pupils Answering "Yes"
Earning Money	76
washing dishes	46
cleaning	38
running errands	76
caring for babies	30 (12 boys, 18 girls)
shoveling snow	27 (23 boys, 4 girls)
selling magazines	17 (boys)
piling wood	9 (8 boys, 1 girl)
paper route	5 (boys)
entertainments	45
buying and reselling	5 (boys)
selling	
candy	14 (boys)
food	1 (girl)
toys	12 (10 boys, 2 girls)
Buying	79
food	79
materials for	
toys	28 (boys)
clothes	31 (5 boys, 26 girls)
Paying Dues for Club	43
Saving Money	79
school bank	79
Measuring	79
weight	79
comparison as to loss or gain	46
height	61
potato race	43 (29 boys, 14 girls)
50 yd. dash	44
100 yd. dash	35
broad jump	33 (29 boys, 4 girls)
high jump	30 (26 boys, 4 girls)
20 yd. swim	26 (20 boys, 6 girls)
40 yd. swim	7 (boys)
ball throw	74
16 boys had measured this for distance	
Cooking	78
candy	65 (22 boys, 43 girls)
cookies	26 (2 boys, 24 girls)
cake	30 (1 boy, 29 girls)
a meal	30 (4 boys, 26 girls)

Summary of Frequencies for Two 6B Rooms (continued)

Experiences	Number of Pupils Answering "Yes"
Lists Kept	76
money spent	76
add it up	66
Christmas list	68
look to see where they can buy cheaper	66
list of amounts bought	27 (6 boys, 22 girls)
list of food for meal	8 (girls)
shopping list	32
Fishing	58 (40 boys, 18 girls)
Skating	66
Baseball	62 (38 boys, 24 girls)
Swimming	53
swimming pool	27 (boys)
Handicraft	45
toys	36 (34 boys, 2 girls)
clothes	20 (girls)
leather	30 (24 boys, 6 girls)
metal	9 (boys)
basketry	22 (girls)
towels	24 (girls)
hooked rugs	4 (girls)
embroidery	36 (girls)
Planning	
map for hike	27
price for food	16
quantities of food	16 (3 boys, 13 girls)
reckoning mileage	58
reading speedometer	56
average distance	5
average time	6
amount of time	
studying	2
walking	18
riding	50

Selection of Most Common Frequencies

Buying	
food	79
materials for	
clothes	31
toys	28
Saving Money	79
Measuring	79
weight	79
height	61
ball throw	74
50 yd. dash	44
potato race	43
100 yd. dash	35
broad jump	35
high jump	30
20 yd. swim	26
Cooking	78
candy	65
cake	30
a meal	30
cookies	26
Earning Money	76
running errands	76
washing dishes	46
entertainments	45
cleaning	38
caring for babies	30
shoveling snow	27
Lists Kept	76
money spent	76
add it up	66
Christmas list	68
look to see where it is cheaper	66
shopping lists	32
Baseball	62
Skating	66
Fishing	58
Swimming	53
Reading Speedometer	56

Selection of Most Common Frequencies (continued)

Reckoning Mileage	56
Amount of Time Riding	50
Handicraft	45
toys	36
embroidery	36
leather	30
towels	20
clothes	20
Paying Dues for Clubs	43

III. Material of Study.

The test which was submitted to the children in the 6B grade consisted of twelve problems which were based on the situations which were found to be most universal in children's experiences, and of twelve other problems which were based on situations more or less foreign to children's experiences. These two sets were matched as 1 and 1', 2 and 2', etc. In so far as possible the processes were kept identical in each set. When this was not possible care was taken to attempt to keep them of equal difficulty. Four groups os problems were included. Group A was in decimals, group B was in fractions, group C included mainly denominate numbers, and group D was made up of easy problems. Six problems were chosen from each group, three of which were within the child's experience and three of which were without the child's experience. These twenty-four problems were then arranged so that no apparent order of either grouping or situation would be noticeable to the child.

The test as it was finally given follows and the problems in it were matched as is shown in the tables in the following pages.

PROBLEMS IN ARITHMETIC

Name ..... School .....

Date ..... Score ..... Score' .....

Age last birthday .....

Directions: Find the answers to as many of these problems as you can. Use the space under each problem to figure on. Do not use any other paper. Write the answer on the answer lines. Do not begin until you are told.

---

1. If you can buy two Yo-yo tops for 25¢, how many can you buy for 50¢? - - - - - - - - - - - - - - - - - Answer .....

2. Mrs. James bought a ham weighing $10\frac{1}{2}$ lbs. A few days later she weighed what was left ot it and found that it weighed only 5 3/8 lbs. How much ham had she used? - - - - - - - - - - - - - - - - - - Answer .....

3. The speedometer on our new car registered 86.7 miles when we started on a trip and 145.2 miles when we returned. Do you know how many miles we had driven? - Answer .....

4. There are 23 children belonging in our class, but only 19 are present. How many are absent? - - - - - Answer .....

5. In Paris you can buy 3 apples for 2 francs. How many apples can you buy for 4 francs? - - - - - - - Answer .....

6. Ned weighs $69\frac{1}{2}$ lbs. and the height-weight chart says he should weigh $64\frac{3}{4}$ lbs. How many pounds overweight is he? - - - - - - - - - - - - - - - - - Answer .....

7. A boat makes 15 knots an hour. How many knots can it make in three hours? - - - - - - - - - - - - - - - Answer .....

8. If two automobiles started for Boston and one averaged 35.4 miles an hour, while the other averaged 24.5 miles an hour, how far apart would they be at the end of the hour? - - - - - - - - - - Answer .....

9. Jane can bake 12 cup cakes in a pan. How many can she bake in four pans? - - - - - - - - - - - - - - Answer .....

10. A salesman traveled 125.9 miles the first day of a trip, 132.5 miles the second day, and 120.8 miles the third day. What was the average number of miles a day? - - - - - - - - - - - - - - - - - - - Answer .....

11. Joe made a running broad jump of 11 ft. 6 in., while Harry made 14 ft. 8 in. How much farther did Harry jump than Joe? - - - - - - - - - - - - - - - Answer .....

Fold this page back and do the next page.

12. A schilling in Austria is worth 14¢. If I exchange a quarter of a dollar for a schilling, how much money will I lose? - - - - - - - - - - - - Answer .....

13. A farmer planted 3/5 of his land to corn. Of this corn, 5/6 was fodder corn. How much of his land was planted to fodder corn? - - - - - - - Answer .....

14. Mary is 4 ft. 7 in. tall. Lena is 5 ft. 2 in. tall. How much taller is Lena than Mary? - - - - - Answer .....

15. John has saved $4.20 in a dime bank. In his school bank he has $17.23. His father says he will give him $10.00 more. How much more will John have to save to get $35.00 for camp? - - - - - Answer .....

16. One farmer raised 100 bu. 3 pk. of potatoes and another farmer raised 75 bu. 2 pk. How much more did the first farmer raise? - - - - - - - - - Answer .....

17. A cake recipe that Marie was using called for $\frac{3}{4}$ cup of butter. Since Marie was taking only half the amounts called for, she needed only ..... of a cup of butter. - - - - - - - - - - - - - - - - Answer .....

18. The measuring rod shows that John is 63 inches tall. How many feet and inches tall is he? - - - - Answer .....

19. If it takes 14 ozs. of flour to make one loaf of bread, how many loaves can be made from 70 lbs? - - Answer .....

20. The German coin called the mark is worth $.25. How many marks can you get for $7.50? - - - - - - - Answer .....

21. Tom weighed $82\frac{3}{4}$ lbs. before he went to camp. After he returned he weighed $89\frac{1}{4}$ lbs. He gained ..... lbs. while he was in camp. - - - - - - - - Answer .....

22. If a square meadow measures 6 rods on one side, how many feet are there in its perimeter? - - - - - Answer .....

23. A freight agent was unpacking boxes from a car, using a hand truck weighing $36\frac{3}{4}$ lbs. He was recording the weight of each box. One box and the truck weighed $84\frac{1}{4}$ lbs.; so he wrote down ..... as the weight of that box. - - - - - - - - - - - - Answer .....

24. Donald wants to buy a winter coat that costs $7.50. He can earn 50¢ every time he shovels snow on a sidewalk. How many sidewalks will he have to shovel to earn the money for his coat? - - - - - - Answer .....

Turn your paper face down and find something to do at your desk.

Group A,--Decimals

	Problem 10	Problem 15
Steps	2	2
Processes	addition of decimals division of decimals	addition of decimals subtraction of decimals

	Problem 3	Problem 8
Steps	1	1
Processes	subtraction of decimals	subtraction of decimals

	Problem 20	Problem 24
Steps	1	1
Processes	division of decimal	division of decimal

Group B,--Fractions

	Problem 2	Problem 6
Steps	1	1
Processes	subtraction of fractions with different denominators	subtraction of fractions with different denominators

	Problem 13	Problem 17
Steps	1	1
Processes	multiplication of fractions	multiplication of fractions

	Problem 21	Problem 23
Steps	1	1
Processes	subtraction of mixed numbers larger denominator in the subtrahend.	subtraction of mixed numbers larger denominator in the subtrahend.

Group C,--Denominate Numbers

	Problem 11	Problem 16
Steps	1	1
Processes	subtraction of compound denominate numbers	subtraction of compound denominate numbers

	Problem 14	Problem 19
Steps	1	2
Processes	subtraction of compound denominate numbers with reduction	reduction of pounds to ounces--division

	Problem 18	*Problem 22
Steps	1	2
Processes	reduction of denominate numbers	reduction of denominate numbers--division

Group D,--Easy Problems

	Problem 1	Problem 5
Steps	2	2
Processes	division--multiplication	division--multiplication

	Problem 4	Problem 12
Steps	1	1
Processes	subtraction	subtraction

	Problem 9	Problem 7
Steps	1	1
Processes	multiplication	multiplication

*Problem 22 is given in the form of finding a perimeter as this is one of the types of problems definitely taught in the 6B grade and presents a stumbling block to many children.

In arranging the problems the easier problems were placed in the first part of the test in order that children not finishing because of difficulty might have the opportunity to solve the easy problems at least. Other than this the problems were arranged only in such a way as to bring no special order of grouping or situations. The order of arrangement is as follows:

Problem Number	*Type of Problem
1	1D
2	1B'
3	2A
4	2D
5	1D'
6	1B
7	3D'
8	2A'
9	3D
10	1A'
11	1C
12	2D'
13	2B'
14	2C
15	1A
16	1C'
17	2B
18	3C
19	2C'
20	3A'
21	3B
22	3C'
23	3B'
24	3A

*Problems based on children's experiences are listed as

Decimals A
Fractions B
Denominate Numbers C
Easy Problems D

Problems not based on children's experience are listed as

Decimals A'
Fractions B'
Denominate Numbers C'
Easy Problems D'

There are three problems in each section.

The timing of the test was determined through a try-out with 153 6A children. The twenty-four problems of the final test were used and the pupils were allowed thirty-minutes as a try-out. The 153 children were in four groups. One group was made up of children with higher intelligence, one a slow group, and one a middle group. The fourth group was a mixed group made up of some very slow 6A children and some bright 6B children who were doing arithmetic of about the same difficulty. The timing of the test was kept in 5-minute periods. The results are tabulated in the following table.[33] It is interesting to note that the superior group shows the most normal distribution with only one unfinished test. The middle group shows the most even distribution with two unfinished tests, and the slow group increases steadily in the longer time limits with seven unfinished tests. The mixed group is quite evenly divided in its timing and has five unfinished tests. In observing this group it was quite evident that the younger 6B half of the room were the ones making up the majority of the pupils finishing early and that most of the unfinished tests were those of the larger, older, more retarded 6A pupils. No one finished in less than ten minutes and the one who finished earliest of the total group completed the test in eleven minutes. Of the total group, 12.4% finished in the 11-15 minute time, 21.5% in 16-20 minutes, 30% in 21-25 minutes, 26.1% in 26-30 minutes, and 9.8% did not finish. Ninety per cent of the total group finished the test. It was decided to allow thirty minutes as the time for giving the test.

From this try-out certain difficulties which children experienced were noted and with these in mind the sheet for directions to teachers was prepared. This sheet is included in the Appendix A.

Although twelve of the problems were based on situations experi-

Timing of the Problems

High Group

Number of Children Finishing		Time in Five-Minute Periods
4	in	15 minutes
9	"	20 "
16	"	25 "
11	"	30 "
1		unfinished

Middle Group

8	in	15 minutes
8	"	20 "
10	"	25 "
10	"	30 "
2		unfinished

Slow Group

2	in	15 minutes
6	"	20 "
10	"	25 "
14	"	30 "
7		unfinished

Mixed Group

5	in	15 minutes
10	"	20 "
10	"	25 "
5	"	30 "
5		unfinished

Table for Total of Groups

Number of children	Time	Per Cent
19	11-15 minutes	12.4
33	16-20 "	21.5
46	21-25 "	30.0
40	26-30 "	26.1
15	unfinished	9.8

enced by children in general, still further study was deemed advisable as a check for individuals. For this purpose a questionnaire was prepared which was given to the pupils the day following the test. This questionnaire consisted of twenty-two questions based on the problems in the test. There are twenty-two of these questions instead of twenty-four because two of the problems involve weighing one's self and are covered by one question, and two involve measuring height and are covered by one question. The validity of this questionnaire can of course be questioned as it is difficult to rely upon children's answers to such questions. This was noticeable in some instances where children had answered "yes" to almost every question, while in other instances there had been an answer of "no" right through the questionnaire. The question concerning foreign money was in several instances answered by "yes." It is, of course, very doubtful that anyone had even heard of the Austrian schilling, to say nothing of using it, yet several replied that they had. Children may confuse the hearing of a franc or the doing of examples involving francs with the experience of spending a franc. Where the majority of children report an experience, however, and where it is in agreement with the study made of children's activities, it can well be considered within the experience of the child. The questions follow.

Name..... School..... Date.....

SOME QUESTIONS TO BE THOUGHT ABOUT

Read the following questions carefully and answer each one as honestly as you can. We do not care whether you answer "yes" or "no" as long as the answer is an honest one. Pay no attention to what your neighbor writes. We wish to know about YOU.

Each of the following questions will ask you if you have ever done something. If you have done this thing several times, will you write YES. If you have never done it or have done it very seldom, will you write NO. If you are not quite sure whether you have done it enough times to write YES, or few enough times to write NO, you may put a question mark (?) for an answer. We hope that almost everyone will be able to write either YES or NO to the questions. Write the answers on the dotted lines.

Questions

1. Have you ever bought a Yo-Yo top? _____
2. Did you ever weigh a ham? _____
3. Have you ever read the speedometer on an automobile? _____
4. Do you know how many children belong in your room? _____
5. Have you ever used a franc? _____
6. Have you ever weighed yourself to see if you have gained? _____
7. Do you know how far a knot is? _____
8. Do you ever reckon how far apart automobiles are? _____
9. Did you ever bake cup cakes in a pan? _____
10. Did you ever reckon the average mileage per day of a car? _____
11. Do you know about how far a good running jump is? _____
12. Have you ever used an Austrian schilling? _____
13. Did you ever plant a field of corn? _____
14. Have you ever measured to see how tall you are? _____
15. Have you ever saved money for anything? _____
16. Have you ever raised a field of potatoes? _____
17. Have you ever measured the quantities for making a cake? _____
18. Have you ever made a dozen loaves of bread? _____
19. Have you ever used a German mark? _____
20. Have you ever measured land? _____
21. Did you ever weigh boxes on a truck? _____
22. Did you ever earn money for anything? _____

Part III.

One Thousand Tests and Their Results

I. Giving of Test and Selection of One Thousand Cases.

The test was given in all 6B grades on December 15th, and followed by the questionnaire the next day. The IQ letter rating was placed on each test by the teacher. These letter ratings are interpreted from numerical IQ's as follows:

130 and over	A
120-129	A
110-119	B
105-109	C
95-104	C
90--94	C-
80-89	D
70-79	E
below 70	E-

All tests having a letter rating below D were discarded that the experiment might be based on children with normal intelligence. All unfinished tests were discarded. By unfinished tests are meant those in which the child had not completed the twenty-fourth example. Tests where this example was completed but earlier ones were omitted were included as it was taken for granted that the earlier problems were omitted because of lack of understanding rather than of time. Tests for which there were no IQ's were discarded, as well as tests for which there was no corresponding questionnaire.

This left a remainder of 1,046 tests which were distributed in the IQ groups as follows:

A	110
B	193
C	582
D	161
Total	1,046

In order to have a thousand cases upon which to work, three cases were discarded from group B, forty-two from group C, one from group D, and none from group A. These discards were selected at random. The grouping as finally used was as follows:

A	110
B	190
C	540
D	160
Total	1,000

These thousand tests were then corrected. Problems which were right were marked correct and those which were wrong or omitted were marked incorrect. The questionnaire of each child was attached to his test.

II. Tabulation

Each problem was tabulated in one of twelve possible ways. It was considered first as within the child's experience or without the child's experience as reported by the child in his questionnaire. It was then considered as right or wrong. If right, it was tabulated under right as experienced or as not experienced. If wrong, it was tabulated as wrong in one of five ways: viz. errors, wrong process, incomplete, omitted, and indeterminate. Errors were

counted only when right process was selected and included errors in computation, reversals of figures, misreading of numbers, errors in writing answers. Wrong process included wrong fundamental operations, neglect to reduce denominate numbers, and neglect to reduce a unit to a fraction when necessary. Incomplete included neglect to finish the problem and occurred in the two-step problems where the first step was taken and the second omitted. The omitted problems were not attempted at all, and for a few problems where it was quite impossible to determine what had been done as no work was visible, it was found necessary to include an indeterminate group.

The results of this tabulation were then compared for each pair of problems as they were matched for experienced and non-experienced situations on the basis of children's activities. In the following pages are given tables showing the results of these problems. For each pair of matched problems a table is given showing the percentages of right processes, right answers, errors in computation in right processes, incomplete problems, omitted problems, and a few indeterminate answers. This is done for each IQ group. A table comparing the percentages for each matched pair of problems as to experience, right process, and right answer, in each IQ group, is given. A table for each matched pair giving the total percentages irrespective of IQ groups is given, showing the comparison of percentages for the two problems as to right process, right answer, errors in computation, wrong process, incomplete problems, and omitted problems. Interpretations of the results for each matched pair are made, and a summary given for each pair of problems. Tables giving total percentages and numbers for each total group of problems, A, B, C, and D, are given and a summary of the results of

each group. These tables show a comparison of the problems based on experienced situations and those based on non-experienced situations for each group of problems, as to right processes, right answers, errors in computation, wrong processes, incomplete problems, and omitted problems.

A final table is given showing a comparison of the results of all problems based on experience and all problems not based on experience irrespective of the type of problem as indicated by the groups A, B, C, and D. This comparison gives numbers and percentages for right processes, right answers, errors in computation, wrong processes, incomplete problems, and omitted problems. A summary is made of these total percentages.

Since there is some uneveness in the apparent equality of these pairs of problems and since the process alone does not always determine the difficulty of the example as uneveness may lodge in certain combinations of number facts within the same process, it was decided to check the equality of difficulty by submitting the numbers and processes involved to 100 children. These were submitted in the form of examples in arithmetic, without problem situations involved, and were given some weeks after the test so that there would be no connection between the two in the minds of the children. The examples as submitted follow and a table giving the results of answers in matched pairs of problems.

Table I, is read as follows: Problems are listed together in matched pairs. The first problem of each pair is one based on an experienced situation, and the second problem is one based on a situation without the child's experience. Reading from left to right, the number of the problem as it was given in the test submitted to

the 6B grade comes first. In the next space is the percentage of correct answers to the computation involved in this problem as given in the check on difficulty. (See page 41) In the next space is the percentage of wrong answers as found in the check on difficulty. The last space is for the problems which required two different processes in computation. In this space is given the percentage for those examples where one of the necessary processes was computed correctly and the second process was computed incorrectly.

The closeness of equality in difficulty for these matched pairs of problems is obvious in almost every case. Two pairs only are questionable. Problems 18 and 22 show an inequality which might make it necessary to disregard these problems in drawing final conclusions. The difficulty in example 22 was in the first half of the operation, where $16\frac{1}{2}$ was to be multiplied by 6. The multiplication of the mixed number presented a difficulty which was not found in the corresponding example of number 18. The other poorly matched pair consists of problem 6 and problem 2. In problem 2 the subtraction of $5\frac{3}{8}$ from $10\frac{1}{2}$ can be done without borrowing from the whole number. In problem 6 ($69\frac{1}{2} - 64\frac{3}{4}$) it is necessary to borrow from the whole number. In almost all other cases any difference in difficulty as shown by differences in correct solutions is in favor of the non-experienced problem as presenting the easier solution.

Check On Difficulty of the Computation Involved in the Twenty-four Problems Given to 6B Grade.

Name..... School..... Date.....

(1) $25\overline{)50}$

$2 \times 2 =$

(2) $10\frac{1}{2}$

$-5\frac{3}{8}$

(3) 145.2
-86.7

(4) 23
-19

(5) $4 \div 2 =$

$2 \times 3 =$

(6) $69\frac{1}{2}$
$-64\frac{3}{4}$

(7) 15
x3

(8) 35.4
-24.5

(9) 12
x4

(10) Add 125.9
132.5
120.8

$3\overline{)379.2}$

(11) 14 ft. 8 in.
-11 ft. 6 in.

(12) 25
-14

(13) $\frac{5}{6} \times \frac{3}{5} =$

(14) 5 ft. 2 in.
-4 ft. 7 in.

(15) Add $ 4.20
17.23
10.00

$35.00
- 31.43

(16) 100 bu. 3 pk.
-75 bu. 2 pk.

(17) $\frac{1}{2} \times \frac{3}{4} =$

(18) $63 \div 12 =$

(19) 16
x70

$14\overline{)1,120}$

(20) $25\overline{)7.50}$

(21) $89\frac{1}{4}$
$-82\frac{3}{4}$

(22) $16\frac{1}{2}$
x6

99
x4

(23) $84\frac{1}{4}$
$-36\frac{3}{4}$

(24) $50\overline{)7.50}$

Table I.

Comparison of Problems As To Difficulty As Shown By Number Correct When Given As Examples Without A Problem Situation.

	Problems	Right	Wrong	Half right
Experienced	1	95%	1%	4%
Not Experienced	5	94%	0	6%
Experienced	6	69%	31%	0
Not Experienced	2	82%	18%	0
Experienced	3	93%	7%	0
Not Experienced	8	100%	0	0
Experienced	4	96%	4%	0
Not Experienced	12	98%	2%	0
Experienced	9	98%	2%	0
Not Experienced	7	98%	2%	0
Experienced	15	71%	0	29%
Not Experienced	10	80%	1%	19%
Experienced	11	84%	16%	0
Not Experienced	16	90%	10%	0
Experienced	17	92%	8%	0
Not Experienced	13	91%	9%	0
Experienced	14	50%	50%	0
Not Experienced	19	67%	33%	0
Experienced	18	83%	17%	0
Not Experienced	22	48%	6%	46%
Experienced	24	82%	18%	0
Not Experienced	20	86%	14%	0
Experienced	21	79%	21%	0
Not Experienced	23	72%	28%	0

Group A,--Decimals

Problems: 15 and 10; 24 and 20; 3 and 8.

Group A consists of three pairs of problems involving decimals. Problem 15 is based on an experienced situation and is matched with problem 10 which is based on a non-experienced situation. Problem 24 is matched with problem 20, and problem 3 is matched with problem 8. For these problems see page 27.

Table II is a tabulation of problem 15 as solved by the 1,000 cases. The answers are tabulated under four IQ groups (see page 36) as to right process, right answer, errors in computation, wrong process, incomplete, omitted, and indeterminate. These classifications are explained on page 37. The numbers are listed for these classifications under the headings "Experienced" and "Not Experienced" according to the questionnaire answered by the children. Total numbers are given and percentages. Right process equals right answers plus errors in computation.

The table is read as follows: Beginning at the left the first space gives the IQ groups A, B, C, and D with the number of cases in each group. The next two spaces give right answers and errors in computation for the problem as reported experienced or not experienced, with total numbers and percentages. The total numbers reading across should equal the number of cases in the IQ group. The percentages of right process, wrong process, incomplete, omitted, and indeterminate should equal 100% and are based on the number of cases in the IQ group. Errors in computation were counted only when the right process was selected. The percentage for these, therefore, has a different basis and is figured on the number of cases in right process. Under this tabulation for each IQ group are given the per-

centages for problems experienced, right processes selected, and right answers achieved for that IQ group.

Table III is a tabulation of problem 10 as solved by the 1,000 cases. The arrangement is exactly the same as that in Table II and is read in the same way.

Table II.

Group A,--Decimals

Tabulation of One Thousand Solutions for Problem 15 in which The Situation Was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	74	35	0	1	0	0
	Not Experienced	0	0	0	0	0	0
	Total No.	74	35	0	1	0	0
	Per Cent	67%	31%	0	.9%	0	0
	Experienced: 100%	Right Process: 99%		Right Answers: 67%			
B 190	Experienced	119	55	3	3	3	2
	Not Experienced	3	2	0	0	0	0
	Total No.	122	57	3	3	3	2
	Per Cent	64%	32%	2%	2%	2%	1%
	Experienced: 97%	Right Process: 94%		Right Answers: 64%			
C 540	Experienced	274	206	15	12	11	7
	Not Experienced	10	2	1	0	2	0
	Total No.	284	208	16	12	13	7
	Per Cent	53%	41%	3%	2%	2%	1%
	Experienced: 97%	Right Process: 91%		Right Answers: 53%			
D 160	Experienced	64	62	9	5	8	4
	Not Experienced	4	3	0	1	0	0
	Total No.	68	65	9	6	8	4
	Per Cent	43%	49%	6%	4%	5%	3%
	Experienced: 95%	Right Process: 83%		Right Answers: 43%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table III.

Group A,--Decimals

Tabulation of One Thousand Solutions for Problem 10 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	18	12	1	9	4	0
	Not Experienced	35	13	0	13	5	5
	Total No.	53	25	1	22	9	0
	Per Cent	48%	31%	.9%	20%	8%	0
	Experienced: 40%	Right Process: 71%		Right Answers: 48%			
B 190	Experienced	22	6	1	20	5	2
	Not Experienced	58	25	6	34	11	0
	Total No.	80	31	7	54	16	2
	Per Cent	42%	28%	4%	28%	8%	1%
	Experienced: 27%	Right Process: 58%		Right Answers: 42%			
C 540	Experienced	58	20	2	50	10	0
	Not Experienced	147	50	12	159	31	1
	Total No.	205	70	14	209	41	1
	Per Cent	38%	25%	3%	38%	8%	.2%
	Experienced: 26%	Right Process: 51%		Right Answers: 38%			
D 160	Experienced	15	3	1	17	2	1
	Not Experienced	27	14	7	62	10	1
	Total No.	42	17	8	79	12	2
	Per Cent	26%	29%	5%	49%	8%	1%
	Experienced: 24%	Right Process: 36%		Right Answers: 26%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table IV.

Group A,--Decimals

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 15 and 10.

IQ	Problem	Experience	Right Process	Right Answer
A	15	100%	99%	67%
110	10	40%	71%	48%
B	15	97%	94%	64%
190	10	27%	58%	42%
C	15	97%	91%	53%
540	10	26%	51%	38%
D	15	95%	83%	43%
160	10	24%	36%	26%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table V.

Group A,--Decimals

Total Numbers and Percentages for Problems 15 and 10 Irrespective of IQ Groups.

Problem 15	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	913	548	365	28	22	24	13
Per Cent	91%	55%	40%	3%	2%	2%	1%

Problem 10	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	523	380	143	30	364	78	5
Per Cent	52%	38%	27%	3%	36%	8%	.5%

This table is read as follows: The upper table gives tabulations for problem 15 based on an experienced situation, and the lower table gives tabulations for problem 10, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,-1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables II, III, IV, V, for Problem 15 (Experienced) and Problem 10 (Non-experienced) in Group A,--Decimals

These two problems judged as experienced and non-experienced from the activity study are found to be consistently so for all IQ groups as reported by the questionnaire. The lowest per cent experiencing the situation in problem 15 is 95% in group D, and the highest, 100% in group A. The lowest per cent experiencing the situation in problem 10 is 24% in group D, and the highest is 40% in group A.

The percentage of right processes selected is markedly higher in the experienced situation, and the difference is greatest in the lower IQ groups. The greatest difference is 47% in the lowest IQ group and the smallest difference is 28% in the highest IQ group. (See Table IV) The problem based on an experienced situation in this case presents some high percentages of selection of right process. The highest is 99% in group A and the lowest is 83% in group D. In contrast to this we find the highest percentage for the unfamiliar situation to be 71% and the lowest to be 36%.

Right answers in the two problems bear the same relations but are noticeably less. For the familiar situation the highest percentage is 67% in group A and the lowest is 43% in group D. For the unfamiliar situation the highest percentage is 48% and the lowest percentage is 26%. This is shown in Table IV.

Errors in computation are more frequent in the experienced problem and show but little increase with decreasing IQ's. The highest per cent of errors is 49% and the lowest is 31%. In the problem based on the unfamiliar situation this order is inverted and the largest per cent of errors in computation is found in the

"A" IQ's, 31%, while the lowest per cent is found in the "C" IQ group, 25%. Tables II and III show this. Total percentages in Table V show 40% for the experienced situation and 27% for the non-experienced situation.

The selection of wrong processes is negligible in both groups and shows much the same percentages, 3% in each case in Table V.

The number of incomplete problems is far in excess in the unfamiliar situation. Problem 15 has .9% as a minimum and 4% as a maximum, while problem 10 has 20% as a minimum and 49% as a maximum. Both show an increase with decreasing IQ's. Table V shows 2% for the experienced activity as against 36% for the non-experienced activity.

Omissions are not large in either problem but are greater in the non-experienced problem, 2% against 8% as shown in Table V.

The individual characteristics of these problems may throw some light on the great difference in completion. Problem 10 is one based on finding an average. This is definitely taught in the schools but is in the mind of the author a seldom experienced activity of a child. For this reason it was purposely included in the non-experienced problems. In correcting this problem it was very evident that many children succeeded in the first step but were confused when it came to finding the average, while in the matched problem the second step was apparently clear.

Summary of Findings in Tables II, III, IV, V, for Problem 15 (Experienced) and Problem 10 (Non-experienced) in Group A,--Decimals.

We are justified in regarding the situation in problem 15 as an experienced one, and that in problem 10 as a non-experienced one.

Problem 15 is very consistently an experienced one for all IQ groups.

Problem 10 is somewhat less consistently a non-experienced one for the higher IQ groups.

In these two problems the selection of right processes is markedly higher in the familiar situation and presents high percentages. (Table V,--91% as against 52%.)

Right answers in the two problems bear the same relation as right processes but are noticeably less. In Table V this is 55% as against 38% in favor of the experienced situation.

Errors in computation are more frequent in the experienced problem, 40% as against 27%. (Table V) In the non-experienced problem these errors are more frequent in the higher IQ groups and less frequent in the lower IQ groups. (Table III)

Selection of wrong processes is negligible in both problems.

Failure to complete the problem is far in excess in the non-experienced problem. Table V shows us 2% for the experienced situation and 36% for the non-experienced situation.

Omissions are small but are somewhat greater in the unfamiliar situation, 2% as against 8% as shown in Table V.

Table VI.

Group A,--Decimals

Tabulation of One Thousand Solutions for Problem 24 in which the Situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	92	9	1	0	0	3
	Not Experienced	5	0	0	0	0	0
	Total No.	97	9	1	0	0	3
	Per Cent	88%	9%	.9%	0	0	3%
	Experienced: 96%	Right Process: 96%	Right Answers: 88%				
B 190	Experienced	148	12	10	0	0	11
	Not Experienced	7	0	2	0	0	0
	Total No.	155	12	12	0	0	11
	Per Cent	82%	14%	6%	0	0	6%
	Experienced: 96%	Right Process: 88%	Right Answers: 82%				
C 540	Experienced	399	81	31	0	1	14
	Not Experienced	10	1	3	0	0	0
	Total No.	409	82	34	0	1	14
	Per Cent	76%	17%	6%	9	.2%	3%
	Experienced: 97%	Right Process: 91%	Right Answers: 76%				
D 160	Experienced	100	22	20	0	1	10
	Not Experienced	5	0	0	0	1	1
	Total No.	105	22	20	0	2	11
	Per Cent	66%	17%	12%	0	1%	7%
	Experienced: 96%	Right Process: 80%	Right Answers: 66%				

*This percentage is based upon the number of right process selections.
See page 43 for explanation.

Table VII.

Group A,--Decimals

Tabulation of One Thousand Solutions for Problem 20 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	1	0	0	0	0	0
	Not Experienced	93	4	7	0	5	0
	Total No.	94	4	7	0	5	0
	Per Cent	86%	4%	6%	0	5%	0
	Experienced: .9%	Right Process: 90%		Right Answers: 86%			
B 190	Experienced	2	1	0	0	2	1
	Not Experienced	140	4	23	0	9	8
	Total No.	142	5	23	0	11	9
	Per Cent	75%	3%	12%	0	6%	5%
	Experienced: 3%	Right Process: 78%		Right Answers: 75%			
C 540	Experienced	9	1	0	0	1	0
	Not Experienced	339	42	85	1	57	5
	Total No.	348	43	85	1	58	5
	Per Cent	65%	12%	16%	.2%	11%	.9%
	Experienced: 2%	Right Process: 73%		Right Answers: 65%			
D 160	Experienced	2	1	3	0	1	0
	Not Experienced	76	8	37	0	30	2
	Total No.	78	9	40	0	31	2
	Per Cent	49%	10%	25%	0	19%	1%
	Experienced: 4%	Right Process: 55%		Right Answers: 49%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table VIII.

Group A,--Decimals

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 24 and 20.

IQ	Problem	Experience	Right Process	Right Answer
A	24	96%	96%	88%
110	20	.9%	90%	86%
B	24	96%	88%	82%
190	20	3%	78%	75%
C	24	97%	91%	76%
540	20	2%	73%	65%
D	24	96%	80%	66%
160	20	4%	55%	49%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table IX.

Group A,--Decimals

Total Numbers and Percentages for Problems 24 and 20 Irrespective of IQ Groups.

Problem 24	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	891	766	125	67	0	3	39
Per Cent	89%	77%	14%	7%	0	.3%	4%

Problem 20	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	723	662	61	155	1	105	16
Per Cent	72%	66%	8%	16%	.1%	11%	2%

This table is read as follows: The upper table gives tabulations for problem 24 based on an experienced situation, and the lower table gives tabulations for problem 20, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,-1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables VI, VII, VIII, IX, for Problem 24 (Experienced) and Problem 20 (Non-experienced) in Group A,--Decimals.

These two problems judged as experienced and non-experienced from the activity study are found to be consistently so for all IQ groups as reported by the questionnaire. The lowest per cent experiencing the situation in problem 24 is 96% for all IQ groups except group B which has 97%. The lowest per cent experiencing the situation in problem 20 is .9% in group A. The highest per cent experiencing the situation in problem 20 is 4% in group D.

The percentage of right processes selected is lower in every case for the non-experienced problem but not so markedly so as in some other problems. The greatest difference is in the lowest IQ group where the percentage of right processes for the familiar situation is 80% and that for the unfamiliar situation is 55%. The percentage of right answers in the two problems bear the same proportionate relation as that of right process but are slightly lower. Total percentages for right process as shown in Table IX are 89% for the experienced situation as against 72% for the non-experienced situation. In the same table right answers show a percentage of 77% for the experienced situation as against 66% for the non-experienced situation.

Errors in computation are more frequent in the familiar situation, showing a decided increase in the two lower IQ groups. The lowest percentage of errors in problem 24 is 9% and the highest is 17%. The lowest percentage of errors in problem 20 is 3% and the highest is 12%. Total percentages as shown in Table IX are .4% for the experienced situation and 8% for the non-experienced situation.

Selection of wrong processes is much less frequent in the familiar situation. In problem 24 the lowest per cent is .9% and the highest is 12%. In problem 20 the lowest per cent of wrong processes is 6% and the highest is 25%. These increased consistently with decreasing IQ's in both problems. Total percentages in Table IX show 16% for the non-experienced situation and 7% for the experienced situation.

Incomplete problems are negligible in both cases.

Omitted problems are negligible in problem 24, 1% being the highest, but are much in excess of this in problem 20. Here the lowest per cent is 5% in group A and 19% in group D. Total percentages for omissions as shown in Table IX are .3% for the familiar situation, and 11% for the unfamiliar situation.

Summary of Findings in Tables VI, VII, VIII, IX, for Problems 24 (Experienced) and Problem 20 (Non-experienced) in Group A,--Decimals.

We are justified in regarding the situation in problem 24 as an experienced one, and that in problem 20 as a non-experienced one.

There is but little difference among the IQ groups as to the per cent of children experiencing the situations.

In this pair of problems children are more successful in solving the problem based on a familiar situation. In the total percentages both right processes and right answers show a higher percentage for the familiar situation. In Table IX, the problem based on an experienced situation has 89% in right processes as against 72% for the non-experienced situation. Right answers have 77% in the experienced situation as against 66% for the non-experienced situation. The higher IQ groups show a larger percentage of children approaching success in the unfamiliar situation than do the lower IQ groups.

Errors in computation are more frequent in the familiar situation, 14% as against 8%. (Table IX)

The selection of wrong process is more frequent in the unfamiliar situation, 16% as against 8%. (Table IX) Both of these errors occur more often in the lower IQ groups.

Omitted problems were almost entirely confined to the unfamiliar situation, 11% as against .3%, (Table IX) and are more frequent in the lower IQ groups.

Incomplete problems are negligible.

Table X.

Group A,--Decimals

Tabulation of One Thousand Solutions for Problem 3 in which the Situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	71	13	8	0	5	1
	Not Experienced	9	1	2	0	0	0
	Total No.	80	14	10	0	5	1
	Per Cent	72%	15%	9%	0	5%	.9%
	Experienced: 89%	Right Process: 85%		Right Answers: 72%			
B 190	Experienced	101	20	31	0	6	2
	Not Experienced	14	5	6	0	5	0
	Total No.	115	25	37	0	11	2
	Per Cent	61%	18%	18%	0	6%	1%
	Experienced: 84%	Right Process: 74%		Right Answers: 61%			
C 540	Experienced	180	51	115	0	22	0
	Not Experienced	67	11	82	1	9	2
	Total No.	247	62	197	1	31	2
	Per Cent	46%	20%	36%	.2%	6%	.4%
	Experienced: 68%	Right Process: 57%		Right Answers: 46%			
D 160	Experienced	44	4	44	0	7	0
	Not Experienced	19	5	27	0	10	0
	Total No.	63	9	71	0	17	0
	Per Cent	39%	12%	44%	0	11%	0
	Experienced: 62%	Right Process: 45%		Right Answers: 39%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XI.

Group A,--Decimals

Tabulation of One Thousand Solutions for Problem 8 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	29	4	1	0	4	0
	Not Experienced	56	6	1	0	9	0
	Total No.	85	10	2	0	13	0
	Per Cent	77%	11%	2%	0	12%	0
	Experienced: 34%	Right Process: 86%		Right Answers: 77%			
B 190	Experienced	50	6	1	0	3	0
	Not Experienced	85	17	6	0	20	2
	Total No.	135	23	7	0	23	2
	Per Cent	71%	15%	4%	0	12%	1%
	Experienced: 32%	Right Process: 83%		Right Answers: 71%			
C 540	Experienced	122	39	9	0	15	0
	Not Experienced	229	71	14	0	41	0
	Total No.	351	110	23	0	56	0
	Per Cent	65%	24%	4%	0	11%	0
	Experienced: 34%	Right Process: 85%		Right Answers: 65%			
D 160	Experienced	37	12	5	0	8	1
	Not Experienced	60	17	5	0	14	1
	Total No.	97	29	10	0	22	2
	Per Cent	61%	23%	6%	0	14%	1%
	Experienced: 46%	Right Process: 79%		Right Answers: 61%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XII.

Group A,--Decimals

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 3 and 8.

IQ	Problem	Experience	Right Process	Right Answer
A	3	89%	85%	72%
110	8	34%	86%	77%
B	3	84%	74%	61%
190	8	32%	83%	71%
C	3	68%	57%	48%
540	8	34%	85%	65%
D	3	62%	45%	39%
160	8	46%	79%	61%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XIII.

Group A,--Decimals

Total Numbers and Percentages for Problems 3 and 8 Irrespective of IQ Groups.

Problem 3	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	615	505	110	315	1	64	5
Per Cent	62%	51%	19%	32%	.1%	6%	.5%

Problem 8	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	840	668	172	42	0	114	4
Per Cent	84%	67%	21%	4%	0	11%	.4%

This table is read as follows: The upper table gives tabulations for problem 3 based on an experienced situation, and the lower table gives tabulations for problem 8, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,-1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables X, XI, XII, XIII, for Problem 3 (Experienced) and Problem 8 (Non-experienced) in Group A,--Decimals.

These two problems which were judged as familiar and unfamiliar do not as reported in the questionnaire bear this out to a marked degree. While problem 3, the familiar situation, always exceeds problem 8 in its percentages for experience, its percentages do not compare favorably with those of the other experienced problems in this group. The highest percentage is 89% in group A, and the lowest is 62% in group D. On the other hand the percentages for problem 8 run much higher than those in the other non-experienced problems in this group. The highest percentage reporting the situation in problem 8 as familiar is 46% and the lowest is 32%. The 62% of problem 3 and the 46% of problem 8 both occur in group D, so that for this group at least and to an extent for the other groups these two problems cannot be said to be highly differentiated as to experience.

The percentages for right processes and right answers are not high for either problem, running from 39% to 86%. In every case the higher percentage is found in the problem presented as an unexperienced one. (See Table XII.) The difference in percentage for each problem is not great except in the lower group of IQ's. Here the problem presented as unfamiliar has 79% right processes and 61% right answers, while the problem presented as familiar has 45% right processes and 39% right answers. Total percentages for right process as shown in Table XIII are 62% for the experienced situation as against 84% for the non-experienced situation. Percentages for right answers shown in the same table are 51% in the experienced situation as against 67% in the non-experienced situation. Errors

in computation are slightly in excess in the familiar problem for the two higher IQ groups, 15% and 18% as against 11% and 15% in the unfamiliar situation. In the lower IQ groups, however, the unfamiliar situation has 24% and 23% as against 20% and 12% in the familiar situation.

The selection of wrong processes is negligible for the problem presented as unfamiliar, ranging from 2% to 6%. For the other problem, however, they show a marked excess, starting with 9% in the A group of IQ's and reaching 44% in the D group.

The incomplete problems are negligible.

The omitted problems are more numerous in the problem presented as unfamiliar especially in the A and B groups of IQ's, 12% in the two higher IQ groups in the unfamiliar situation as against 5% and 6% in the familiar situation.

It is difficult to see in the individual characteristics of the two problems much to account for the great difference in selection of wrong process. It was noted in correcting that many children added instead of subtracting in problem 3. It is possible that the order of the numbers may have had some influence. In problem 8 the larger number comes first and may more easily suggest subtraction where there is confusion as to what process to use. In problem 3 the smaller number comes first and may tend to inhibit the idea of subtraction where there is confusion as to what process to use. (See page 27) The difference in difficulty in the two subtractions themselves did not appear to be great in the check on difficulty given in preceding pages. Here it can be noted problem 3 had 93% right and problem 8 had 100% right. This was the only problem having 100% right. (Table I)

Summary of Findings in Tables X, XI, XII, XIII, for Problem 3 (Experienced) and Problem 8 (Non-experienced) in Group A,--Decimals

We cannot regard these two problems as highly differentiated as to experience. This is especially true in the two lower IQ groups. (See Table XII)

The percentages for right processes and right answers are not high for either problem but in every case the problem presented as unfamiliar shows the higher percentage. Table XIII shows us 62% right processes and 51% right answers in the familiar situation as against 84% right processes and 67% right answers in the unfamiliar situation. The differences of percentage for the two problems are small but show the widest difference in the D group of IQ's.

Errors in computation are nearly equal for the two problems but slightly in excess in the problem presented as unfamiliar especially for the C and D groups of IQ's.

Selection of wrong process shows a marked excess for the problem presented as familiar. Total percentages in Table XIII show 32% in the familiar situation as against 4% in the unfamiliar situation. This is especially true in the lower IQ groups.

Incomplete problems are negligible.

Omissions are somewhat more numerous in the problem presented as unfamiliar especially in the higher IQ groups. Table XIII has 11% in the unfamiliar situation as against 6% in the familiar situation.

The excess in selection of wrong process in problem 3 is not apparently due to difference in difficulty according to the previous check. It is possible that it lies in the arrangement of the numbers involved. (See explanation on page 64)

Table XIV.

Table XIV which follows gives the total numbers and percentages of the 3,000 solutions for the three problems which were judged to be based on an experienced situation and for the 3,000 solutions for the three problems which were judged to be based on a non-experienced situation.

The table is read as follows: Beginning at the left the first space gives the classification as right process, right answer, error in computation, wrong process, incomplete answer, omitted, or indeterminate. The next space designates the line upon which to find the number and the line upon which to find the percentage. The next space gives the number and the percentage for the experienced situations, and the last space gives the number and percentage for the non-experienced situation. Omitting right answers and errors in computation, the numbers added down should give the number of solutions,-3,000. Omitting right answers and errors in computation, the percentages added down should give 100% except for fractions of per cents. Right answers plus errors in computation equal right process. With the exception of errors in computation all percentages are found on the basis of the number of solutions,-3,000. Errors in computation are taken only from solutions where the right process was used, so are found on the basis of the number of right processes selected.

Table XIV.

Total Numbers and Percentages for Group A,--Decimals Irrespective of Groupings Except Problems Based On Experienced Situations and Problems Based on Non-experienced situations.

		Experienced Situation	Non-experienced Situation
Right Process	Number	2,419	2,086
	Per Cent	81%	70%
Right Answers	Number	1,819	1,710
	Per Cent	61%	57%
Errors in Computation	Number	600	376
	Per Cent	25%	18%
Wrong Process	Number	410	227
	Per Cent	14%	7%
Incomplete	Number	23	365
	Per Cent	.7%	12%
Omitted	Number	91	297
	Per Cent	3%	10%
?	Number	57	25
	Per Cent	2%	.8%

This table is explained on page 66.

General Summary for Group A,--Decimals

There are six problems in this group, three selected as representing an experienced situation and three as representing a non-experienced situation. Problems 15, 24, and 3 represent experienced situations and problems 10, 20, and 8 represent non-experienced situations.

Experience.

All of these problems show a differentiation as to experience. Two of the pairs, 15 and 10, and 24 and 20, show a very marked difference as to experience as reported by the children's questionnaires. This is true for all IQ groups. Table IV for problems 15 and 10 shows 100% to 95% for the problem judged as experienced as against 40% to 24% for the problem judged as non-experienced. Table VIII for problems 24 and 20 shows 97% to 96% for the problem judged as experienced as against 4% to .9% for the problem judged as non-experienced. The third pair of problems does not show so marked a difference. Table XII shows 89% to 62% for the familiar situation as against 46% to 32% for the unfamiliar situation. The variation of percentages of experience for various IQ groups is not marked enough to show any general tendency of increase or decrease.

Right Process and Right Answer.

In the total percentages, Table XIV, the problems based on experienced situations show a higher percentage of selection of right process, 81% as against 70% in the unfamiliar situation. In this same table the problems based on experience have a higher percentage of right answers also, 61% as against 57% for the unfamiliar situation.

In separate pairs of matched problems the two pairs which show a marked difference in experience show a higher percentage of right processes and right answers in the problems based on experience. (See Tables IV and VIII) In the pair of problems showing a small difference as to experience the percentage of right answers and right processes is not high and the problem presented as unfamiliar shows a higher percentage. These percentages tend to decrease with a decreasing IQ.

Errors in Computation.

In the total percentages errors in computation show a higher percentage in the experienced situation. Table XIV gives 25% errors in computation for the experienced situation as against 18% for the non-experienced situation. Errors in computation are tabulated only from right processes selected and the per cent is figured on the number of right processes selected as a base.

In the two problems showing the highest difference as to experience, errors in computation are more frequent in the familiar situation. (See Tables V and IX) In one case errors are more frequent in the higher IQ groups and in the other case they are more frequent in the lower IQ groups. (See Tables II, III, and Tables VI, VII) In the pair of problems showing a small difference as to experience, errors in computation are nearly equal for the two problems but slightly in excess for the problem presented as unfamiliar, in the lower IQ groups. (See Tables X, XI, XIII)

Wrong Process.

In the total percentages, Table XIV, the experienced situation shows a higher percentage of wrong processes. This is probably

partly due to the marked excess of wrong processes for problem 3 which is based on a familiar situation. Problem 3 is one of a matched pair which shows a small difference as to experience, and the excess of wrong processes appears to be due to the arrangement of the numbers involved. (See explanation on page 64) In one of the pairs of problems showing a marked difference in experience, the selection of wrong process is higher in the unfamiliar situation, 16% as against 7%, Table IX. In the other pair, showing a difference in experience, the selection of wrong process is negligible in both problems, 3%, Table V.

Incomplete Problems.

Failure to complete the problem is a noticeable factor in only one pair of problems. Here failure to complete the problem is far in excess in the non-experienced situation, 36% as against 2% in the experienced situation. This is in problem 10, Table V. Problems 10 and 15 are the only two step problems for this group. The excess of failure in problem 10 may also be due to a characteristic of the individual problem, in this case the process of finding an average. (See page 50).

Omissions.

In all cases omissions are almost entirely confined to problems in the unfamiliar group. In the total percentages, Table XIV, the unfamiliar situation has 10% omissions as against 3% in the familiar situation.

Group B,--Fractions

Problems: 17 and 13; 21 and 23; 2 and 6.

Group B consists of three pairs of problems involving fractions. Problem 17 is based on an experienced situation and is matched with problem 13 which is based on a non-experienced situation. Problem 21 is matched with problem 23, and problem 2 is matched with problem 6. For these problems see page 27. The tables in Group B are like those in Group A and are read in the same way. (See page 43.)

Table XV.

Group B,--Fractions

Tabulation of One Thousand Solutions for Problem 17 in which the Situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	31	1	12	0	5	0
	Not Experienced	41	1	17	0	2	0
	Total No.	72	2	29	0	7	0
	Per Cent	66%	3%	26%	0	6%	0
	Experienced: 45%	Right Process: 68%	Right Answers: 66%				
B 190	Experienced	42	3	18	0	8	3
	Not Experienced	54	0	46	0	11	5
	Total No.	96	3	64	0	19	8
	Per Cent	50%	3%	34%	0	10%	4%
	Experienced: 50%	Right Process: 52%	Right Answers: 50%				
C 540	Experienced	63	9	90	0	22	0
	Not Experienced	123	4	175	2	52	0
	Total No.	186	13	265	2	74	0
	Per Cent	35%	7%	48%	.4%	14%	0
	Experienced: 34%	Right Process: 38%	Right Answers: 35%				
D 160	Experienced	13	0	19	0	11	1
	Not Experienced	19	4	63	0	30	0
	Total No.	32	4	82	0	41	1
	Per Cent	20%	11%	51%	0	26%	.7%
	Experienced: 27%	Right Process: 23%	Right Answers: 20%				

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XVI.

Group B,--Fractions

Tabulation of One Thousand Solutions for Problem 13 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	3	0	5	0	2	0
	Not Experienced	24	1	46	0	29	0
	Total No.	27	1	51	0	31	0
	Per Cent	24%	4%	47%	0	28%	0
	Experienced: 9%	Right Process: 25%		Right Answers: 24%			
B 190	Experienced	6	0	4	0	3	1
	Not Experienced	35	1	88	0	49	3
	Total No.	41	1	92	0	52	4
	Per Cent	22%	2%	49%	0	27%	2%
	Experienced: 7%	Right Process: 23%		Right Answers: 22%			
C 540	Experienced	11	0	34	0	15	0
	Not Experienced	83	8	260	2	126	1
	Total No.	94	8	294	2	141	1
	Per Cent	17%	8%	55%	.4%	26%	.2%
	Experienced: 11%	Right Process: 19%		Right Answers: 17%			
D 160	Experienced	4	1	15	0	7	0
	Not Experienced	25	3	70	0	35	0
	Total No.	29	4	85	0	42	0
	Per Cent	18%	12%	53%	0	26%	0
	Experienced: 17%	Right Process: 21%		Right Answers: 18%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

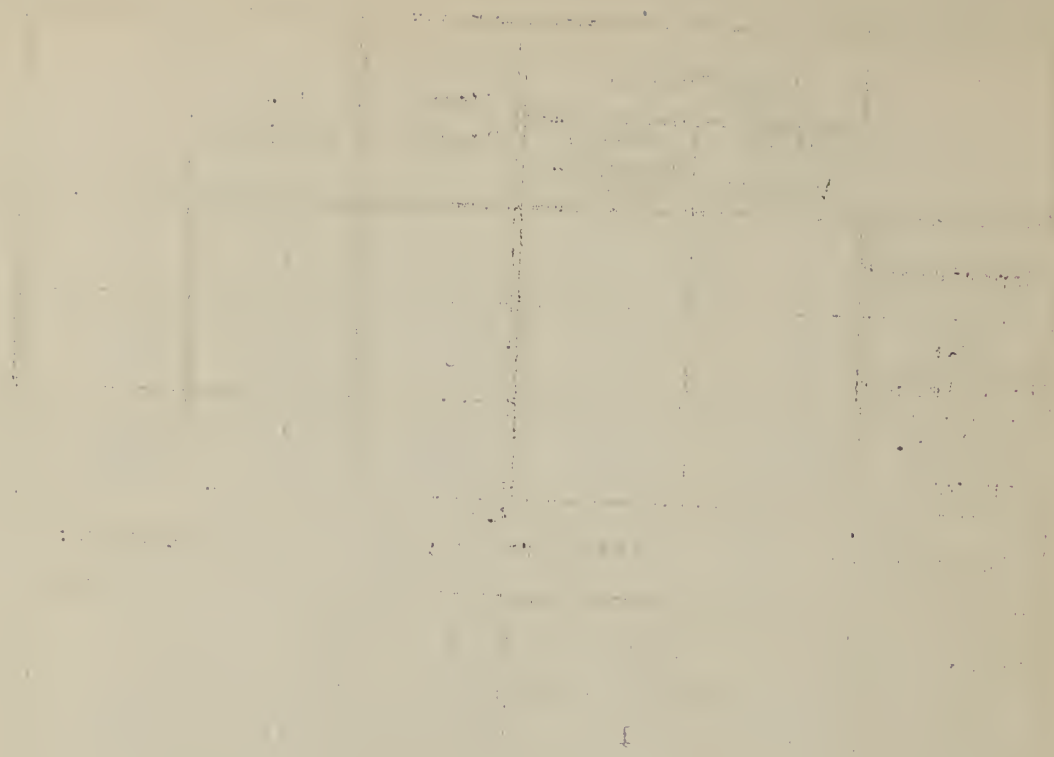

Table XVII.

Group B,--Fractions

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 17 and 13.

IQ	Problem	Experience	Right Process	Right Answer
A	17	45%	68%	66%
110	13	9%	25%	24%
B	17	50%	52%	50%
190	13	7%	23%	22%
C	17	34%	38%	35%
540	13	11%	19%	17%
D	17	27%	23%	20%
160	13	17%	21%	18%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XVIII.

Group B,--Fractions

Total Numbers and Percentages for Problems 17 and 13 Irrespective of IQ Groups.

Problem 17	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	408	386	22	440	2	141	9
Per Cent	41%	39%	5%	44%	.2%	14%	.9%

Problem 13	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	205	191	14	522	2	266	5
Per Cent	21%	19%	7%	52%	.2%	27%	.5%

This table is read as follows: The upper table gives tabulations for problem 17 based on an experienced situation, and the lower table gives tabulations for problem 13, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases, --1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XV, XVI, XVII, XVIII, for Problem 17 (Experienced) and Problem 13 (Non-experienced) in Group B,--Fractions

Problem 17, selected as an experienced situation, is not found to be so widely experienced as many of the others, according to the questionnaire. Table XV shows the highest percentage reporting it as experienced to be 50% in the B group and the lowest 27% in the D group. It is interesting to note that this problem is one of cooking, experienced mainly by the girls probably, so that the drop in the percentage tends to confirm our questionnaire as to validity.

Problem 13, selected as a non-experienced situation, is consistently so in all IQ groups. The percentage increases somewhat with decreasing IQ's so that the lowest IQ's are not highly differentiated as to experience in the two problems. Table XVI shows the highest percentage reporting the situation as familiar to be 17% in the D group and the lowest percentage, 7% in the C group.

The percentage of right processes selected is higher in every group for the familiar situation and bears a proportional relation to the percentage experiencing the situation. Table XVIII shows 41% right processes in the experienced situation as against 21% in the non-experienced situation. The percentage of right answers is almost identical with that of right processes. Both right answers and right processes decrease in percentages with decreasing IQ's. (See Table XVII)

Percentages of errors in computation are small in both problems. Table XVIII shows 5% in the experienced situation as against 7% in the non-experienced situation.

Selection of wrong processes is more frequent in the unfamiliar

situation especially in the higher IQ groups as shown in Tables XV and XVI. Total percentages as shown in Table XVIII are 44% for the familiar situation as against 52% for the unfamiliar situation.

Incomplete problems are negligible.

Omissions are identical in the D group of IQ's but are more frequent for the non-experienced situation in the higher groups. Total percentages for omissions as shown in Table XVIII are 14% for the experienced situation as against 27% for the non-experienced situation.

Summary of Findings in Tables XV, XVI, XVII, XVIII, for Problem 17 (Experienced) and Problem 13 (Non-experienced) in Group B,--Fractions

We are justified in regarding the situation in problem 13 as a non-experienced one. The report of experience for problem 17 does not show a high percentage but is consistent in all IQ groups, and consistent with the percentages of right answers and right processes. Since the problem refers to an experience more common to girls, the percentages reported are lower and tend to substantiate the validity of the questionnaire. If interpreted in this light the problem may still yield valuable results.

In the familiar situation the percentage of children experiencing it tends to decrease with a decreasing IQ, while in the unfamiliar situation the percentage tends to increase with a decreasing IQ.

In this pair of problems the percentage of right processes selected is higher in every group for the familiar situation and bears a proportional relation to the percentage experiencing the situation. Table XVIII shows 41% for the experienced situation as against 21% for the non-experienced situation. The percentage of right answers is almost identical with that of right processes. Both right answers and right processes decrease in percentages with decreasing IQ's. (See Tables XV and XVI)

Errors in computation are negligible in both problems, 5% in the experienced situation and 7% in the non-experienced situation.

Selection of wrong processes is more frequent in the unfamiliar situation, especially in the higher IQ groups. Total percentages are 44% for the familiar situation as against 52% for the unfamiliar situation.

Omissions are more frequent in the higher IQ groups and identical in the D group of IQ's. In the total percentages, omissions are more numerous in the unfamiliar situation, 27% as against 14% in the familiar situation.

Incomplete problems are negligible.

Table XIX.

Group B,--Fractions

Tabulation of One Thousand Solutions for Problem 21 in which the Situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	71 (6)	31	0	0	5	0
	Not Experienced	2	0	0	0	1	0
	Total No.	73	31	0	0	6	0
	Per Cent	67%	30%	0	0	5%	0
	Experienced: 97%	Right Process: 95%	Right Answers: 67%				
B 190	Experienced	122 (13)	49	4	0	6	1
	Not Experienced	7	1	0	0	0	0
	Total No.	129	50	4	0	6	1
	Per Cent	68%	28%	2%	0	3%	.5%
	Experienced: 96%	Right Process: 94%	Right Answers: 68%				
C 540	Experienced	303 (47)	185	6	2	26	0
	Not Experienced	9 (3)	6	2	0	1	0
	Total No.	312	191	8	2	27	0
	Per Cent	58%	36%	2%	.4%	5%	0
	Experienced: 96%	Right Process: 93%	Right Answers: 58%				
D 160	Experienced	65 (18)	64	10	0	14	3
	Not Experienced	3 (1)	1	0	0	0	0
	Total No.	68	65	10	0	14	3
	Per Cent	42%	49%	6%	0	9%	2%
	Experienced: 97%	Right Process: 83%	Right Answers: 42%				

The extra figure in the right answer space is explained on page 85.

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XX.

Group B,--Fractions

Tabulation of One Thousand Solutions for Problem 23 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	1	0	0	0	0	0
	Not Experienced	64	21	11	0	13	0
	Total No.	65	21	11	0	13	0
	Per Cent	59%	24%	10%	0	12%	0
	Experienced: .9%	Right Process: 78%	Right Answers: 59%				
B 190	Experienced	3	3	1	0	3	1
	Not Experienced	82	28	27	0	34	8
	Total No.	85	31	28	0	37	9
	Per Cent	45%	27%	15%	0	19%	5%
	Experienced: 6%	Right Process: 61%	Right Answers: 45%				
C 540	Experienced	9	3	4	0	7	0
	Not Experienced	165	126	79	1	144	2
	Total No.	174	129	83	1	151	2
	Per Cent	32%	43%	15%	.2%	28%	.4%
	Experienced: 4%	Right Process: 56%	Right Answers: 32%				
D 160	Experienced	2	1	5	0	6	0
	Not Experienced	30	24	39	0	52	1
	Total No.	32	25	44	0	58	1
	Per Cent	20%	44%	27%	0	36%	.6%
	Experienced: 9%	Right Process: 36%	Right Answers: 20%				

*This percentage is based upon the number of right process selections. See page 43 for explanation.

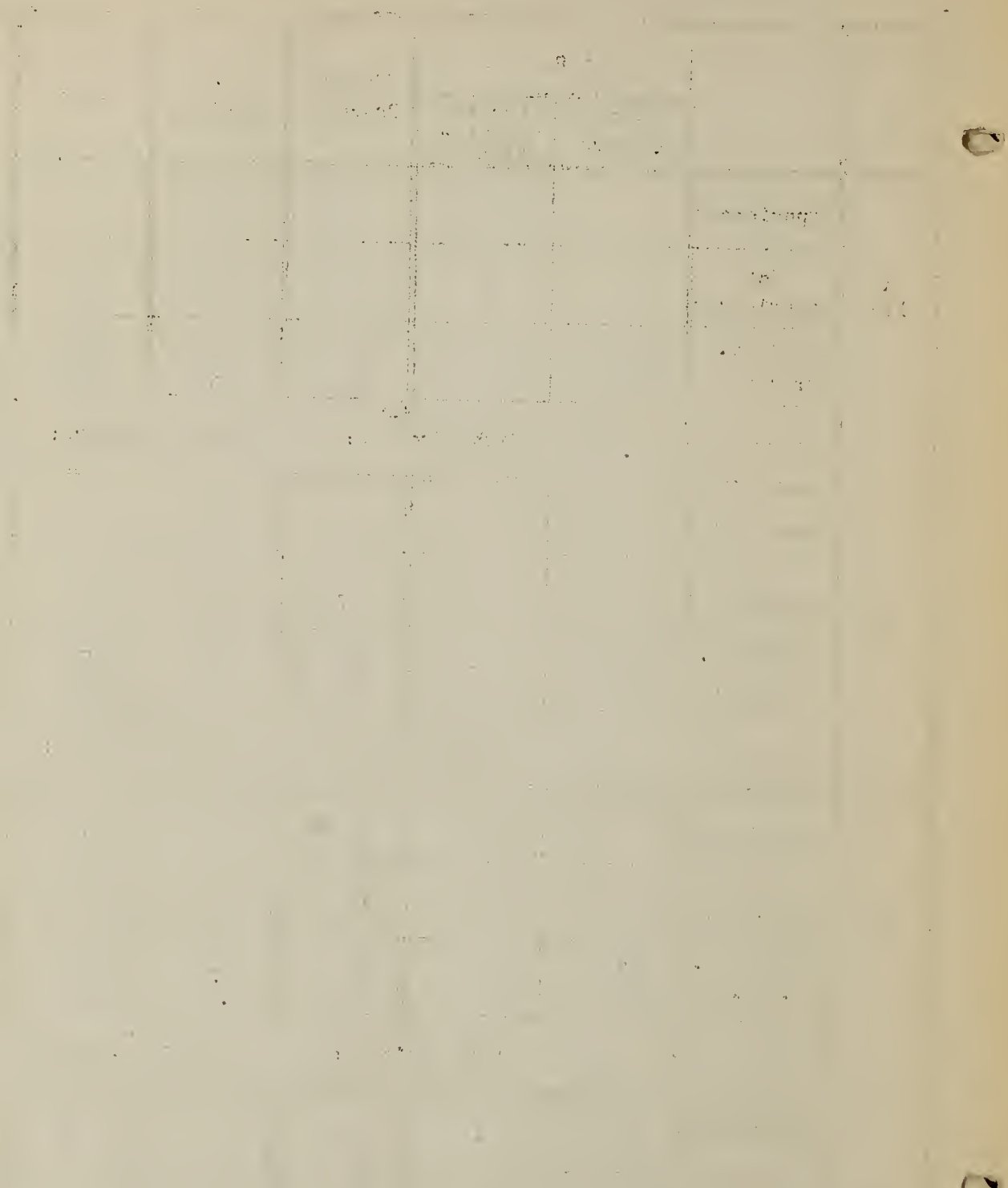

Table XXI.

Group B,--Fractions

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 21 and 23.

IQ	Problem	Experience	Right Process	Right Answer
A	21	97%	95%	67%
110	23	.9%	78%	59%
B	21	96%	94%	68%
190	23	6%	61%	45%
C	21	96%	93%	58%
540	23	4%	56%	32%
D	21	97%	83%	42%
160	23	9%	36%	20%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XXII.

Group B,--Fractions

Total Numbers and Percentages for Problems 21 and 23 Irrespective of IQ Groups.

Problem 21	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	919	582	337	22	2	53	4
Per Cent	92%	58%	37%	2%	.2%	5%	.4%

Problem 23	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	562	356	206	166	1	259	12
Per Cent	56%	36%	36%	17%	.1%	26%	1%

This table is read as follows: The upper table gives tabulations for problem 21 based on an experienced situation, and the lower table gives tabulations for problem 23, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables IX, XX, XXI, XXII, for Problem 21 (Experienced) and Problem 23 (Non-experienced) in Group B,--Fractions

These two problems judged as experienced and non-experienced from the activity study are found to be consistently so for all IQ groups as reported by the questionnaire. The lowest percentage experiencing the situation in problem 21 is 96% and the highest is 97%. In problem 23 the lowest percentage reporting the situation as experienced is .9% in group A and the highest is 9% in group D.

The percentage of right processes is higher in every group for the familiar situation. In Table XXII, the familiar situation has 58% and the unfamiliar situation has 36%. The difference in percentages for the different IQ groups grows larger with decreasing IQ's. In the lowest group it is markedly larger, being 83% for the familiar situation and only 36% for the unfamiliar situation, as shown in Table XXI.

The percentage of right answers is larger in every group for the familiar situation, and though considerably smaller than the percentage of right process, bears much the same proportional relationship. In Table XXII the familiar situation has 58% as against 36% in the unfamiliar situation. Errors in computation are almost the same for both problems, 37% for the familiar and 36% for the unfamiliar situation. In the familiar situation they increase with decreasing IQ's. In the unfamiliar situation the percentage of errors in computation is much the same for all IQ groups.

Selection of wrong process is much larger for the non-experienced problem, and increases with decreasing IQ. Here the lowest percentage is 10% and the highest 27%. The selection of wrong process for the experienced situation is negligible, being 0% in the A group and 6%

in the D group. Table XXII gives the total percentage as 2% for the familiar situation and 17% for the unfamiliar situation.

There are almost no incomplete problems.

Omissions are much more numerous in the unfamiliar situation, running from 12% in the A group to 36% in the D group. In the familiar situation the percentages of omissions are small, running from 3% in the B group to 9% in the D group. Table XXII shows total percentages to be 5% for the familiar situation.

For problem 21 a slight error in mimeographing must be noted. A cancellation mark appears by mistake through the fraction in $82\frac{3}{4}$. About 10% of the children regarded this as a cancellation and subtracted 82 from $89\frac{1}{4}$, getting an answer of $7\frac{1}{4}$ instead of $6\frac{1}{2}$. These answers were counted as right and are so included in the percentages. In the table the actual number of examples so interpreted is given in the upper right hand corner of the space devoted to right answers. The results of this error are not considered large enough to invalidate the problem.

Summary of Findings in Tables IX, XX, XXI, XXII, for Problems 21 (Experienced) and 23 (Non-Experienced) in Group B,--Fractions

We are justified in regarding the situation in problem 21 as an experienced one and that in problem 23 as a non-experienced one. There is but small variation among the IQ groups as to the percentage of children experiencing the situations.

The percentage of children selecting the right process and the percentage of right answers is higher in every IQ group for the problem representing an experienced situation. The difference in percentages for the two problems is greatest in the lower IQ groups. In the total percentages both right processes and right answers show a higher percentage for the familiar situation. In Table XXII the problem based on experience has 92% in right processes as against 56% for the non-experienced situation. Right answers have 58% in the experienced situation as against 36% for the non-experienced situation.

Table XXII shows errors in computation to be almost identical for the two problems. The problem based on experience has 37% errors in computation and the problem not based on experience has 36% errors in computation. They increase with decreasing IQ's in the familiar situation. In the unfamiliar situation the percentage of errors in computation is much the same for all IQ groups.

Selection of wrong process is much larger for the non-experienced problem, and increases with decreasing IQ. In the familiar situation the selection of wrong process is negligible. Table XXII shows 2% in the familiar situation as against 17% in the unfamiliar situation.

There are almost no incomplete problems.

Omissions are much more numerous in the unfamiliar situation, 26%. The percentage of omissions is small in the familiar situation, 5%.

Table XXIII.

Group B,--Fractions

Tabulation of One Thousand Solutions for Problem 6 in which the Situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	72	26	0	0	0	2
	Not Experienced	4	5	1	0	0	0
	Total No.	76	31	1	0	0	2
	Per Cent	69%	29%	.9%	0	0	2%
	Experienced: 99%	Right Process: 97%	Right Answers: 69%				
B 190	Experienced	117	55	3	0	1	4
	Not Experienced	8	2	0	0	0	0
	Total No.	125	57	3	0	1	4
	Per Cent	66%	31%	2%	0	.5%	2%
	Experienced: 95%	Right Process: 96%	Right Answers: 66%				
C 540	Experienced	293	202	8	0	7	2
	Not Experienced	17	10	0	0	1	0
	Total No.	310	212	8	0	8	2
	Per Cent	57%	40%	2%	0	2%	.4%
	Experienced: 95%	Right Process: 96%	Right Answers: 57%				
D 160	Experienced	72	72	3	0	4	5
	Not Experienced	1	2	1	0	0	0
	Total No.	73	74	4	0	4	5
	Per Cent	46%	50%	3%	0	3%	3%
	Experienced: 98%	Right Process: 92%	Right Answers: 46%				

*This percentage is based upon the numberof right process selections. See page 43 for explanation.

Table XXIV.

Group B,--Fractions

Tabulation of One Thousand Solutions for Problem 2 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	9	3	0	0	0	0
	Not Experienced	84	13	1	0	0	0
	Total No.	93	16	1	0	0	0
	Per Cent	85%	15%	.9%	0	0	0
	Experienced: 11%	Right Process: 44%	Right Answers: 85%				
B 190	Experienced	22	5	0	0	2	0
	Not Experienced	128	21	6	0	2	4
	Total No.	150	26	6	0	4	4
	Per Cent	79%	15%	4%	0	2%	2%
	Experienced: 15%	Right Process: 93%	Right Answers: 79%				
C 540	Experienced	67	17	2	0	1	0
	Not Experienced	354	82	11	0	6	0
	Total No.	421	99	13	0	7	0
	Per Cent	78%	19%	2%	0	1%	0
	Experienced: 16%	Right Process: 96%	Right Answers: 78%				
D 160	Experienced	18	3	2	0	3	0
	Not Experienced	85	34	9	0	6	0
	Total No.	103	37	11	0	9	0
	Per Cent	64%	26%	7%	0	6%	0
	Experienced: 16%	Right Process: 88%	Right Answers: 64%				

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XXV.

Group B,--Fractions

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 2 and 6.

IQ	Problem	Experience	Right Process	Right Answer
A	6	99%	97%	69%
110	2	11%	99%	85%
B	6	95%	96%	66%
190	2	15%	93%	79%
C	6	95%	96%	57%
540	2	16%	96%	78%
D	6	98%	92%	46%
160	2	16%	88%	64%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XXVI.

Group B,--Fractions

Total Numbers and Percentages for Problems 6 and 2 Irrespective of IQ Groups.

Problem 6	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	958	584	374	16	0	13	13
Per Cent	96%	58%	39%	2%	0	1%	1%

Problem 2	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	945	767	178	31	0	20	4
Per Cent	95%	77%	19%	3%	0%	2%	.4%

This table is read as follows: The upper table gives tabulations for problem 6 based on an experienced situation, and the lower table gives tabulations for problem 2, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XXIII, XXIV, XXV, XXVI, for Problem 6 (Experienced) and Problem 2 (Non-experienced) in Group B,--Fractions.

These two problems judged as experienced and non-experienced from the activity study are found to be consistently so for all IQ groups as reported by the questionnaire. The lowest percentage experiencing the situation in problem 6 is 95% in groups B and C, and the highest is 99% in group A. In problem 2 the highest percentage reporting the situation as an experienced one is 16% in groups C and D, and the lowest per cent is 11% in group A.

The percentages of right processes are high for both problems and show no particular relation, being higher for problem 2 in two groups and higher for problem 6 in the other two groups. The highest percentage for problem 6 is 97% and the lowest is 92%. In problem 2 the highest percentage is 99% and the lowest is 88%. Table XXVI shows total percentages in right process to be 96% for the familiar situation and 95% for the unfamiliar situation.

The drop in percentage of right answers is much greater for the experienced situation. Here the highest percentage is 69% in group A and this decreases with decreasing IQ's to 46% in group D. The drop in problem 2 is much less. Here the highest percentage is 85% in group A, and this decreases with decreasing IQ'S to 64% in the D group. This makes the total percentage of right answers larger for the non-experienced situation, 77% as against 58%.

Errors in computation are much more frequent in the familiar situation. The lowest, 29% in the A group increases with decreasing IQ groups to 50% in the D group. In the unfamiliar situation errors in computation run from 15% in the A group to 26% in the D group.

Total errors in computation are 39% in the familiar situation as against 19% in the unfamiliar situation.

Selection of wrong process is negligible for both problems but shows a slight increase in the lowest IQ group for the unfamiliar situation.

There are no incomplete problems.

Omissions are negligible but slightly larger in the unfamiliar problem.

Some explanation of these results is to be found in the nature of the two problems and in their matching. Problem 2, the unfamiliar situation, is quoted directly from the textbook used in this grade and may for this reason have represented a certain amount of drill in this particular situation. In the check-up for difficulty, these two problems were not found to be well matched. The computation in problem 2, the unfamiliar situation, was done correctly by 82% of the children, while the computation for problem 6 was accomplished successfully by only 69%. (See Table I) In both problems fractions have to be changed to a common denominator before subtracting, but in problem 6, the familiar problem, an additional difficulty is met in that it is necessary to borrow from the whole number before subtracting. This accounts to a large extent for the excess of errors in problem 6 and for the drop in right answers. It is probable that this is enough of a factor to invalidate this pair of problems in their results.

Summary of Findings in Tables XXIII, XXIV, XXV, XXVI, for Problem 6 (Experienced) and Problem 2 (Non-experienced) in Group B,--Fractions

We are justified in regarding the situation in problem 6 as an experienced one and that in problem 2 as a non-experienced one.

There is little difference among the IQ groups as to the per cent of children experiencing the situations.

In this case children have a larger percentage of errors in computation in the experienced situation and a larger percentage of right answers in the non-experienced situation. When errors are thrown with right answers, the difference in percentages of right processes selected is very small. (See Table XXVI)

There is but little difference in the percentages of selection of wrong processes, these being negligible for both problems.

There are no incomplete problems.

Omissions are negligible, but slightly larger in the unfamiliar problem.

These two problems are not well matched for difficulty according to the check on difficulty. One presents a difficulty in subtraction with borrowing which the other one does not present, and may account for an excess of failures in computation. The other is a quotation from the textbook in use and may represent a certain amount of drill, thus raising the number of right answers.

Enough uneveness of equality is found in these two problems to invalidate the conclusions from the results.

Table XXVII.

Total Numbers and Percentages for Group B,--Fractions Irrespective of Groupings Except as Problems Based On Experienced Situations and Problems Based On Non-Experienced Situations.

		Experienced Situation	Non-experienced Situation
Right Process	Number	2,285	1,712
	Per Cent	76%	59%
Right Answers	Number	1,552	1,314
	Per Cent	52%	44%
Errors in Computation	Number	733	398
	Per Cent	33%	23%
Wrong Process	Number	478	719
	Per Cent	16%	25%
Incomplete	Number	4	3
	Per Cent	.1%	.1%
Omitted	Number	207	545
	Per Cent	7%	18%
?	Number	26	21
	Per Cent	.9%	.7%

This table is read exactly like Table XIV. See page 66 for explanation.

General Summary for Group B,--Fractions

There are six problems in this group, three selected as representing an experienced situation, and three as representing a non-experienced situation. Problems 17, 21, and 2 represent experienced situations and are matched by problems 13, 23, and 6 as representing non-experienced situations.

Experience

All three pairs show a difference as to experience as reported by the children's questionnaires. This is true of all IQ groups. In two pairs, problems 21 and 23, and problems 2 and 6, the difference in experience is markedly high. Table XXI for problems 21 and 23 shows 97% to 96% for the problem judged as experienced, and 9% to .9% for the problem judged as non-experienced. Table XXV, for problems 6 and 2, shows 99% to 95% for the experienced situation as against 11% to 16% for the non-experienced situation. In the third pair, 17 and 13, the problem selected as non-experienced shows a low percentage of experience, 7% to 17%, but the problem selected as experienced does not show as high a percentage as in the other pairs, 50% to 27%. It is based on an activity more common to girls and the smaller percentage is consistent with this and tends to substantiate the validity of the questionnaire. In all three pairs of problems there is small variation among the IQ groups as to percentage of children experiencing the situation in any one problem.

Right Process and Right Answer

In the total percentages, Table XXVII, the problems based on experienced situations show a higher percentage of selection of right process, 76% as against 59% in the unfamiliar situation. In the same

table the problems based on experience have a higher percentage of right answers also, 52% as against 44% for the unfamiliar situation. This is true even including the pair of problems which were somewhat invalidated and which tend to lessen the difference in percentages.

In two pairs of problems, Tables XVII and XXI, the percentage of children selecting right processes and achieving right answers is higher in every IQ group for the familiar problem. In the other pair, Table XXV, there is but little difference in percentage of right processes for the familiar and unfamiliar situations and this difference shows no general tendency. Right answers for this problem shows a larger percentage for the non-experienced problem. In this pair the matching is not good and the familiar problem shows a larger percentage of failure in the check on difficulty. (See Table I)

Errors in Computation

In the total percentages errors in computation show a higher percentage in the experienced situation. Table XXVII gives 33% errors in computation for the experienced problem as against 23% for the non-experienced situation. Errors in computation are tabulated only from right processes selected and the per cent is figured on the number of right processes as a base.

Omitting the pair of problems which are poorly matched for difficulty, errors in computation would be almost identical for both experienced and non-experienced situations. Table XVIII shows 5% for the familiar situation as against 7% for the unfamiliar, and Table XXII shows 37% for the familiar situation as against 36% for the unfamiliar situation.

Wrong Process

In the total percentages, Table XVII, the non-experienced problem shows a larger percentage of wrong processes selected, 25% as against 16% in the experienced situation. Selecting of wrong process is much higher in the unfamiliar situation for the two pairs of problems where difficulty is more equalized. Tables XVIII and XXII show differences of 44% against 52% in the first instance and 2% against 17% in the second instance. The other pair has much the same percentage of wrong process selected, 2% for the familiar situation and 3% for the unfamiliar situation.

Incomplete Problems

Incomplete problems are lacking or very negligible.

Omissions

In all cases omissions of problems is greater for the unfamiliar situation. In the total percentages, Table XXVII, the unfamiliar situation has 18% omissions as against 7% in the familiar situation.

Group C,--Denominate Numbers

Problems: 18 and 22; 11 and 16; 14 and 19.

Group C consists of three pairs of problems involving denominate numbers. Problem 18 is based on a situation judged to be experienced and is matched with problem 22 which is based on a situation judged to be non-experienced. Problem 11 is matched with problem 16, and problem 14 is matched with problem 19. These problems are found on page 27. The tables in Group C are like those in Group A and are read in the same way. For explanation of these tables see page 44.

Table XXVIII.

Group C,--Denominate Numbers

Tabulation of One Thousand Solutions for Problem 18 in which the situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	94	5	2	0	0	0
	Not Experienced	7	1	0	0	1	0
	Total No.	101	6	2	0	1	0
	Per Cent	92%	6%	2%	0	.9%	0
	Experienced: 92%	Right Process: 96%		Right Answers: 92%			
B 190	Experienced	152	3	9	0	7	5
	Not Experienced	10	0	3	0	1	0
	Total No.	162	3	12	0	8	5
	Per Cent	85%	2%	6%	0	4%	3%
	Experienced: 93%	Right Process: 87%		Right Answers: 85%			
C 540	Experienced	352	46	48	4	44	6
	Not Experienced	26	1	8	1	4	0
	Total No.	378	47	56	5	48	6
	Per Cent	70%	11%	10%	.9%	9%	1%
	Experienced: 93%	Right Process: 79%		Right Answers: 70%			
D 160	Experienced	83	15	25	1	25	0
	Not Experienced	6	1	0	0	4	0
	Total No.	89	16	25	1	29	0
	Per Cent	56%	15%	16%	.6%	18%	0
	Experienced: 93%	Right Process: 66%		Right Answers: 56%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XXIX.

Group C,--Denominate Numbers

Tabulation of One Thousand Solutions for Problem 22 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	2	2	5	2	10	0
	Not Experienced	11	0	31	16	31	0
	Total No.	13	2	36	18	41	0
	Per Cent	11%	15%	33%	16%	37%	0
	Experienced: 19%	Right Process: 14%		Right Answers: 11%			
B 190	Experienced	6	0	12	7	11	1
	Not Experienced	7	4	54	29	53	6
	Total No.	13	4	66	36	64	7
	Per Cent	7%	24%	35%	19%	34%	4%
	Experienced: 19%	Right Process: 15%		Right Answers: 7%			
C 540	Experienced	3	2	32	19	22	1
	Not Experienced	18	4	158	93	188	0
	Total No.	21	6	190	112	210	1
	Per Cent	4%	21%	35%	21%	39%	2%
	Experienced: 15%	Right Process: 5%		Right Answers: 4%			
D 160	Experienced	0	1	10	7	13	0
	Not Experienced	1	1	34	24	68	1
	Total No.	1	2	44	31	81	1
	Per Cent	.6%	1%	27%	19%	51%	.6%
	Experienced: 19%	Right Process: 2%		Right Answers: .6%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XXX.

Group C,--Denominate Numbers

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 18 and 22.

IQ	Problem	Experience	Right Process	Right Answer
A	18	92%	96%	92%
110	22	19%	14%	11%
B	18	93%	87%	85%
190	22	19%	15%	7%
C	18	93%	79%	70%
540	22	15%	5%	4%
D	18	93%	66%	56%
160	22	19%	2%	.6%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XXXI.

Group C,--Denominate Numbers

Total Numbers and Percentages for Problems 18 and 22 Irrespective of IQ Groups.

Problem 18	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	802	730	72	95	6	86	11
Per Cent	80%	73%	9%	9%	.6%	9%	1%

Problem 22	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	62	48	14	336	197	396	9
Per Cent	6%	5%	23%	34%	20%	40%	.9%

This table is read as follows: The upper table gives tabulations for problem 18 based on an experienced situation, and the lower table gives tabulations for problem 22, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XXVIII, XXIX, XXX, XXXI, for Problem 18 (Experienced) and Problem 22 (Non-experienced) in Group C,--Denominate Numbers

These two problems judged as experienced and as non-experienced from the activity study are found to be so designated by the questionnaire. The difference in the two per cents is not quite so large as in some of the other pairs of problems but of sufficient size to be significant. The largest per cent reporting the situation as experienced in problem 18 was 93% in all IQ groups but A where it was 92%. The largest per cent reporting problem 22 as representing an experienced situation was 19% in all IQ groups but C. This problem is one of those about which we can question the validity of the questionnaire. It is probably doubtful if as large a per cent of children have measured land as is reported and it may be that familiarity with perimeter, which is definitely taught in the 6B grade, may be responsible for some effect in raising this percentage. This would probably depend on the recency with which each child had worked with such a problem. The difference as reported, however, is considered great enough in itself to justify us in regarding these problems as respectively experienced and non-experienced.

The per cent of children using the right process for problem 18, the experienced situation, is far in excess of those using the right process for problem 22, the non-experienced situation, 80% as against 6% as shown in Table XXXI. These percentages decrease for both problems with decreasing IQ groups. Table XXX shows 96% to 66% for the experienced situation as against 15% to 2% for the non-experienced situation.

The percentage of right answers is slightly lower in each case than the selection of right process, but far in excess for the experi-

enced problem in each IQ group. Table XXX shows 92% to 56% for the experienced situation as against 11% to .6% for the non-experienced situation. The percentages decrease with the decreasing IQ groups for each problem. Total percentages for right answers are 73% for the familiar situation as against 5% for the unfamiliar situation as shown in Table XXXI. The problem based on a non-experienced situation has a much larger percentage of errors in computation. Table XXXI shows 23% in the unfamiliar situation as against 9% in the familiar situation.

The selection of wrong process is far in excess in the non-experienced situation. In Table XXXI for total percentages the familiar situation has 9% as against 34% in the unfamiliar situation. In Table XXVIII for the experienced problem these percentages of wrong process selected show an increase with decreasing IQ but in Table XXIX for the non-experienced problem they show no general tendency for IQ groups.

The non-experienced problem has a much higher percentage of incomplete problems. Table XXXI shows 23% as against 9% for the experienced problem. It is possible that the comparison of incomplete solutions for these two problems should be discarded as problem 22 involved two steps, while problem 18 did not. They were not well equalized in this respect.

Omissions are much higher for the non-experienced situation. Table XXXI shows 40% for the non-experienced situation as against 9% for the experienced situation.

These two problems are not well matched. As has been mentioned above, problem 22 involved an extra step and in the check on difficulty showed a difference in equality of difficulty in

computation. (See Table I) However, it is interesting to note that the preponderance of omissions and incomplete solutions in problem 22 prevented many children from arriving at the difficulty in computation. It is thought worth while to include this problem in the study in spite of an unused inequality as it throws some light on the subject in that the situation itself apparently caused enough confusion to prevent many attempts at a multiplication ($6 \times 6\frac{1}{2}$) which might have produced many errors.

Summary of Findings in Tables XXVIII, XXIX, XXX, XXXI, for Problem 18 (Experienced) and Problem 22 (Non-experienced) in Group C,--Denominate Numbers

We are justified in regarding the situation in these two problems as experienced and non-experienced respectively.

There is almost no difference in the percentage of children experiencing the situations for the varying IQ groups.

The percentage of right processes is much higher in the problem involving the experienced situation. Table XXXI shows 80% in the experienced situation as against 6% in the non-experienced situation.

The percentage of right answers is far in excess for the familiar situation. Total percentages for right answers are 73% for the familiar situation as against 5% for the unfamiliar situation. An element entering into this is an inequality of difficulty as shown in the check on difficulty. This inequality is, however, counterbalanced to an extent by the large number of omissions and selection of wrong processes, preventing children from arriving at the place where the difficulty in multiplication was to be reached. For explanation of this see page 40.

Errors in computation are much larger for the non-experienced situation, 23% as ageinst 9% as shown in Table XXXI.

Selection of wrong process shows a much higher percentage for the inexperienced problem than for the experienced problem. Total percentages are 9% for the familiar situation as against 34% for the unfamiliar situation. This shows no consistent relation to the IQ groups.

An excess of incomplete problems for problem 22 is invalidated by the inequality of the two problems as a one-step problem (18) and a two-step problem (22). (See page 104 for explanation of this)

Omissions were much more numerous in the unfamiliar situation. Table XXXI shows 40% for the non-experienced situation as against 9% for the experienced situation.

Table XXXII.

Group C,--Denominate Numbers

Tabulation of One Thousand Solutions for Problem 11 in which the Situation is Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	41	1	1	0	0	0
	Not Experienced	61	3	2	0	1	0
	Total No.	102	4	3	0	1	0
	Per Cent	93%	4%	3%	0	.9%	0
	Experienced: 39%	Right Process: 97%		Right Answers: 93%			
B 190	Experienced	70	6	1	0	0	0
	Not Experienced	98	6	7	0	2	0
	Total No.	165	12	8	0	2	0
	Per Cent	89%	6%	4%	0	1%	0
	Experienced: 41%	Right Process: 95%		Right Answers: 89%			
C 540	Experienced	171	18	6	0	10	0
	Not Experienced	262	33	22	0	17	1
	Total No.	433	51	28	0	27	1
	Per Cent	80%	11%	5%	0	5%	1%
	Experienced: 38%	Right Process: 89%		Right Answers: 80%			
D 160	Experienced	48	5	5	0	3	0
	Not Experienced	69	8	15	0	7	0
	Total No.	117	13	20	0	10	0
	Per Cent	73%	10%	13%	0	6%	0
	Experienced: 38%	Right Process: 81%		Right Answers: 73%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XXXIII.

Group C,--Denominate Numbers

Tabulation of One Thousand Solutions for Problem 16 in which the Situation Was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	4	0	1	0	0	0
	Not Experienced	98	2	2	0	3	0
	Total No.	102	2	3	0	3	0
	Per Cent	92%	2%	3%	0	3%	0
	Experienced: 5%	Right Process: 94%		Right Answers: 92%			
B 190	Experienced	16	1	1	0	1	0
	Not Experienced	157	9	2	0	0	3
	Total No.	173	10	3	0	1	3
	Per Cent	91%	6%	2%	0	.5%	2%
	Experienced: 10%	Right Process: 96%		Right Answers: 91%			
C 540	Experienced	39	3	2	0	1	0
	Not Experienced	436	30	19	2	8	0
	Total No.	475	33	21	2	9	0
	Per Cent	88%	7%	4%	.4%	2%	0
	Experienced: 8%	Right Process: 94%		Right Answers: 88%			
D 160	Experienced	17	0	0	0	2	0
	Not Experienced	101	19	12	0	8	1
	Total No.	118	19	12	0	10	1
	Per Cent	74%	14%	8%	0	6%	.6%
	Experienced: 12%	Right Process: 86%		Right Answers: 74%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XXXIV.

Group C,--Denominate Numbers

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 11 and 16.

IQ	Problem	Experience	Right Process	Right Answer
A	11	39%	97%	93%
110	16	5%	94%	92%
B	11	41%	95%	89%
190	16	10%	96%	91%
C	11	38%	89%	80%
540	16	8%	94%	88%
D	11	38%	81%	73%
160	16	12%	86%	74%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XXXV.

Group C,--Denominate Numbers

Total Numbers and Percentages for Problems 11 and 16, Irrespective of IQ Groups.

Problem 11	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	900	820	80	59	0	40	1
Per Cent	90%	82%	9%	6%	0	4%	.1%

Problem 16	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	932	868	64	39	2	23	4
Per Cent	93%,	87%	7%	4%	.2%	2%	.4%

This table is read as follows: The upper table gives tabulations for problem 11 based on an experienced situation, and the lower table gives tabulations for problem 16, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computaion, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XXXII, XXXIII, XXXIV, XXXV, for Problems 11 (Experienced) and Problem 16 (Non-experienced) in Group C,--Denominate Numbers

These two problems judged as experienced and non-experienced from the activity study are found to be so as reported by the questionnaire. They are not, however, as highly differentiated as many of the other pairs of problems. The unfamiliar situation shows percentages similar to other unfamiliar problems, but the familiar situation has not as high percentages as most of the other familiar situations. As in problem 17 this activity is more common to one sex and the lower percentage probably reflects this and tends to substantiate the validity of the questionnaire. Table XXXIV shows 41% as the highest percentage in the experienced problem and 38% as the lowest percentage. In the non-experienced problem 12% is the highest and 5% is the lowest.

The variations in percentages show no particular relation to IQ groups in either problem.

The percentage of right processes is very close for the two problems, being sometimes a bit higher for one problem and sometimes a bit higher for the other. The percentage is a high one. Table XXXV shows the total percentages to be 90% for the experienced situation and 93% for the non-experienced situation.

The percentage of right answers is also high, very close for the two problems and with no particular relation to IQ groups. Table XXXV shows 82% for the experienced situation and 87% for the non-experienced situation.

Errors in computation are slightly higher in the familiar situation, 9% as against 7% in the unfamiliar situation,--Table XXXV. They increase with a decreasing IQ as shown in Tables XXXII and XXXIII.

Selection of wrong process is also close in the percentages for each problem and shows a slight increase with decreasing IQ's. Table XXXV shows 6% for the experienced situation as against 4% for the non-experienced situation.

There are no incomplete problems in the familiar situation and very few in the unfamiliar situation,--.2%.

Omissions are much the same for the two problems. They are negligible and show a slight increase with decreasing IQ's. Table XXXV shows 4% for the familiar situation and 2% for the unfamiliar situation.

It is difficult to see in the individual characteristics of these two problems an outstanding factor which may cause the apparent variation in results. It may be due to some outside factor such as recency of drill, etc., for which we can have no information in our study.

Summary of Findings in Tables XXXII, XXXIII, XXXIV, XXXV, for Problem 11 (Experienced) and Problem 16 (Non-experienced) in Group C,--Denominate Numbers.

These two problems are not as highly differentiated as to experience and non-experience as reported by the questionnaire as most of the other problems. The factor of an activity common to one sex enters in as in one other problem and the percentages for that one problem are correspondingly lower. The difference in percentages for the two problems is, however, considered enough to call them experienced and non-experienced, bearing this interpretation in mind.

The variations in percentages of experience bear no particular relation to IQ groups.

The percentage of right processes is high for both problems and very close. Total percentages in Table XXXV are 90% for the experienced situation and 93% for the non-experienced situation.

The percentage of right answers is also high and close for the two problems and bears no particular relation to IQ. Table XXXV shows 82% for the experienced situation and 87% for the non-experienced situation.

Errors in computation are slightly higher for the familiar situation, 9% as against 7%. They increase with decreasing IQ.

Selection of wrong process is close in the percentages for each problem and shows a slight increase with decreasing IQ groups. Table XXXV gives 6% for the experienced situation as against 4% for the non-experienced situation.

There are no incomplete problems in the familiar situation and but few in the unfamiliar situation.

Omissions are negligible and much the same for the two problems. They show a slight increase for decreasing IQ groups. Table XXXV

gives 4% for the familiar situation and 2% for the unfamiliar situation.

This variation in results does not appear to be accounted for by individual characteristics within the problem itself.

Table XXXVI.

Group C,--Denominate Numbers

Tabulation of One Thousand Solutions for Problem 14 in which the Situation was Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	51	16	33	0	4	0
	Not Experienced	12	0	4	0	0	0
	Total No.	63	16	37	0	4	0
	Per Cent	57%	9%	34%	0	4%	0
	Experienced: 86%	Right Process: 62%	Right Answers: 57%				
B 190	Experienced	69	17	82	0	2	1
	Not Experienced	10	2	7	0	0	0
	Total No.	79	19	89	0	2	1
	Per Cent	42%	19%	47%	0	1%	.5%
	Experienced: 90%	Right Process: 52%	Right Answers: 42%				
C 540	Experienced	186	49	218,	0	12	5
	Not Experienced	27	6	36	0	1	0
	Total No.	213	55	254	0	13	5
	Per Cent	39%	21%	48%	0	2%	.9%
	Experienced: 87%	Right Process: 49%	Right Answers: 39%				
D 160	Experienced	30	13	90	0	5	0
	Not Experienced	11	1	8	0	2	0
	Total No.	41	14	98	0	7	0
	Per Cent	26%	25%	61%	0	4%	0
	Experienced: 86%	Right Process: 36%	Right Answers: 27%				

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XXXVII.

Group C,--Denominate Numbers

Tabulation of One Thousand Solutions for Problem 19 in which the Situation was Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	0	1	1	0	0	0
	Not Experienced	21	3	61	0	23	0
	Total No.	21	4	62	0	23	0
	Per Cent	19%	16%	56%	0	21%	0
	Experienced: 2%	Right Process: 23%		Right Answers: 19%			
B 190	Experienced	0	0	1	0	1	0
	Not Experienced	17	3	127.	1	38	2
	Total No.	17	3	128	1	39	2
	Per Cent	9%	15%	67%	.5%	20%	1%
	Experienced: 1%	Right Process: 11%		Right Answers: 9%			
C 540	Experienced	0	1	10	0	3	0
	Not Experienced	28	14	373	3	108	0
	Total No.	28	15	383	3	111	0
	Per Cent	5%	35%	71%	.6%	21%	0
	Experienced: 3%	Right Process: 8%		Right Answers: 5%			
D 160	Experienced	0	0	4	0	1	0
	Not Experienced	4	5	111	0	35	0
	Total No.	4	5	115	0	36	0
	Per Cent	3%	56%	72%	0	22%	0
	Experienced: 3%	Right Process: 6%		Right Answers: 3%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

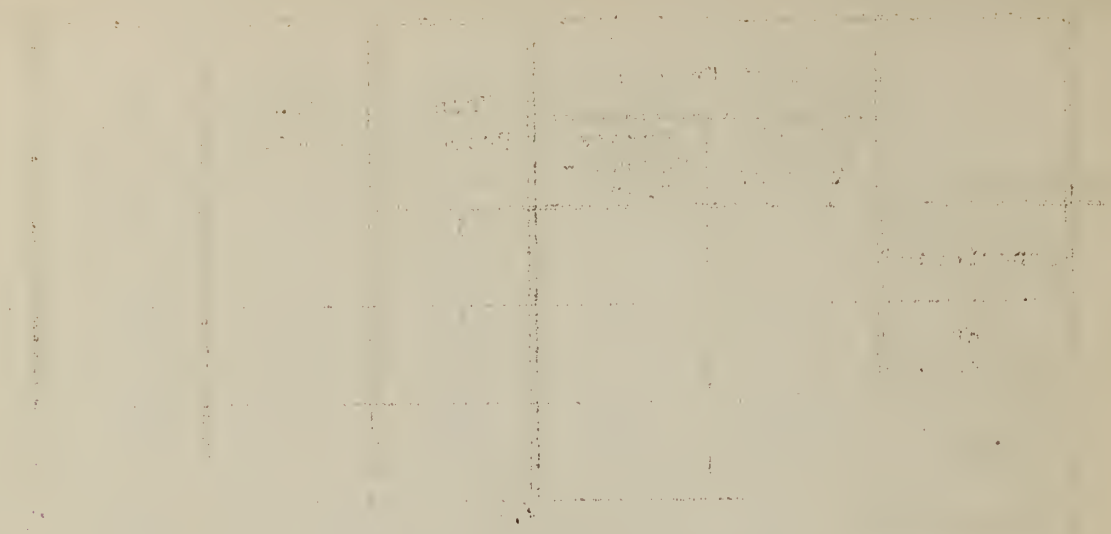

Table XXXVIII.

Group C,--Denominate Numbers

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 14 and 19.

IQ	Problem	Experience	Right Process	Right Answer
A	14	86%	62%	57%
110	19	2%	23%	19%
B	14	90%	52%	42%
190	19	1%	11%	9%
C	14	87%	49%	39%
540	19	5%	8%	5%
D	14	86%	36%	26%
160	19	3%	6%	3%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XXXIX.

Group C,--Denominate Numbers

Total Numbers and Percentages for Problems 14 and 19 Irrespective of IQ Groups.

Problem 14	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	490	396	94	478	0	26	6
Per Cent	49%	40%	19%	48%	0	3%	.6%

Problem 19	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	97	70	27	688	4	209	2
Per Cent	10%	7%	28%	69%	.4%	21%	.2%

This table is read as follows: The upper table gives tabulations for problem 14 based on an experienced situation, and the lower table gives tabulations for problem 10, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XXXVI, XXXVII, XXXVIII, XXXIX, for Problem 14 (Experienced) and Problem 19 (Non-experienced) in Group C,--Denominate Numbers

These two problems, judged experienced and non-experienced from the activity study, are found to be consistently so for all IQ groups, as reported by the questionnaire. The highest percentage experiencing problem 14 is 90% in the B group and the lowest is 86% in the A and D groups. The highest percentage experiencing the situation in problem 19 is 5% in the C group and the lowest is 1% in the B group. There appears to be no consistent relation to IQ groups. (See Table XXXVIII)

The percentage of right processes is larger in every group for the familiar situation and decreases with a decreasing IQ. Table XXXVIII shows the percentages of right process in the familiar situation run from 62% to 36%. In the unfamiliar situation they run from 23% to 6%. Total percentages in Table XXXIX are 49% for the experienced situation and 10% for the non-experienced situation.

The percentage of right answers is larger in every group for the familiar situation and decreases with a decreasing IQ. In Table XXXVIII the percentages of right answers for the experienced situation run from 57% to 26%, and in the non-experienced situation from 19% to 3%. Total percentages in Table XXXIX are 40% for the experienced situation as against 7% for the non-experienced situation.

Errors in computation are larger in the non-experienced problem and the difference in percentages for the two problems is greater in the lower IQ groups. Errors in computation for the experienced situation, Table XXXVI, run from 9% to 25%. In the non-experienced situation, Table XXXVII, they run from 15% to 56%. Total percentages for errors in computation, Table XXXIX, are 19% in the experienced situa-

tion as against 28% in the non-experienced situation.

Selection of wrong process is much larger for the unfamiliar situation and for each problem increases with a decreasing IQ. Problem 14 has 34% wrong processes in the A group and 61% in the D group, while problem 19 has 56% in the A group and 72% in the D group. Total percentages for wrong process, Table XXXIX, are 48% for the experienced situation and 69% for the non-experienced situation.

There are no incomplete problems in 14 and they are negligible in problem 19.

Omissions are far in excess in problem 19. The lowest percentage of omissions here is 20% and the highest is 22% while in problem 14 the lowest is 1% and the highest is 4% as shown in Tables XXXVI and XXXVII. Total percentages for omissions as shown in Table XXXIX are 3% for the experienced situation and 21% for the non-experienced situation.

Summary of Findings in Tables XXXVI, XXXVII, XXXVIII, XXXIX, for Problem 14 (Experienced) and Problem 19 (Non-experienced) in Group C,--Denominate Numbers.

We are justified in regarding the situation in problem 14 as an experienced one and that in problem 19 as a non-experienced one. The variation is not great among the IQ groups as to the percentage of children experiencing the situations.

The percentage of right answers and right processes is larger in every group for the familiar situation and decreases with a decreasing IQ. Total percentages for right process as shown in Table XXXIX are 49% for the experienced situation and 10% for the non-experienced situation. Total percentages for right answers as shown in this table are 40% for the experienced situation as against 7% for the non-experienced situation.

Errors in computation are larger for the non-experienced problem and the difference in percentages for the two problems is greater in the lower IQ groups. Table XXXIX shows 19% errors in computation for the experienced situation as against 28% for the non-experienced situation.

Selection of wrong process is much larger for the unfamiliar situation and for each problem increases with a decreasing IQ. Total percentages for wrong process, Table XXXIX, are 48% for the experienced situation and 69% for the non-experienced situation.

Incomplete problems are negligible.

Omissions are far in excess in the unfamiliar situation. Table XXXIX shows 3% omissions for the experienced situation and 21% for the non-experienced situation.

Table XL.

Total Numbers and Percentages for Group C,--Denominate Numbers Irrespective of Groupings Except As Problems Based On Experienced Situations and Problems Based On Non-Experienced Situations.

		Experienced Situation	Non-experienced Situation
Right Process	Number	2,192	1,091
	Per Cent	73%	36%
Right Answers	Number	1,946	986
	Per Cent	65%	33%
Errors in Computation	Number	246	105
	Per Cent	11%	10%
Wrong Process	Number	632	1,063
	Per Cent	21%	35%
Incomplete	Number	6	203
	Per Cent	.2%	7%
Omitted	Number	152	628
	Per Cent	5%	21%
?	Number	18	15
	Per Cent	.6%	.5%

This table is read exactly like Table XIV. See page 66 for explanation.

General Summary for Group C,--Denominate Numbers

There are six problems in this group, three selected as representing an experienced situation and three as representing a non-experienced situation. Problems 18, 11, and 14 represent experienced situations and are matched with problems 22, 16, and 19 as representing non-experienced situations.

Experience

All three pairs of problems may be regarded as showing a difference as to experience as reported by the children's questionnaires. This difference is a marked one in two pairs of problems. Problem 18 shows percentages of experience from 93% to 92% as against 19% to 15% for problem 22. This is shown in Table XXX. Problem 14 shows percentages of experience from 90% to 86% as against 5% to 1% for problem 10. This is shown in Table XXXVIII. In the other pair, problems 11 and 16, the non-experienced situation is highly so, the percentages running only from 12% to 55%, but the experienced situation has lower percentages than is usual, running from 41% to 38%. These percentages are shown in Table XXXIV. This low percentage for the familiar situation is due to the fact that it is based on a situation more common to girls than to boys. Again this tends to substantiate the validity of the questionnaire.

The variation in percentage of experience for the various IQ groups is negligible in two pairs of problems and bears no particular relation to the IQ in the other pair.

Right Process and Right Answer

In the total percentages, Table XL, the problems based on experi-

enced situations show a much higher percentage, 73% as against 35% in the non-experienced situation. In the same table the problems based on experience also have a much larger percentage of right answers, 65% as against 33% for the non-experienced situation.

In the two pairs of problems which differentiate to the highest degree in the matter of experience, the percentage of right answers and right processes is larger in every IQ group for the familiar situation. This is shown in Tables XXX and XXXVIII. In the other pair the percentages for right processes and right answers is high for both problems. This is shown in Table XXXIV. This variation of results does not seem to be accounted for by individual characteristics within the problem itself, but may be due to some outside factor as recency of drill.

In all three pairs of problems the percentages of right process and right answer decreases with a decreasing IQ.

Errors in Computation

In the total percentages, Table XL, errors in computation are very close but slightly larger in the experienced situation, 11% as against 10%. Errors in computation are tabulated only from right processes selected and the per cent is figured on the number of right processes as a base.

In two pairs of problems where the situation was more highly differentiated as to experience, the larger percentage of errors was found in the non-experienced situation. This is shown in Tables XXXI and XXXIX. In the other pair, Table XXXV, the experienced situation shows a slightly larger percentage of errors in computation.

Wrong Process

In the total percentages, Table XL, the selection of wrong proc-

ess is larger in the non-experienced situation, 35% as against 21% in the experienced situation. In the two pairs of problems showing a higher differentiation as to experience, the selection of wrong process is larger in the unfamiliar situation. Tables XXXI and XXXIX show a difference of 9% as against 34% in the first instance and 48% as against 69% in the second instance. In the other pair the percentage of wrong processes is very close, 6% for the familiar situation as against 4% for the unfamiliar situation, as shown in Table XXXV.

Incomplete Problems

Incomplete problems are negligible or absent in two of the pairs of problems. In the other pair, incomplete problems are far in excess in the non-experienced situation. This result is, however, invalidated by an inequality in the number of steps involved. An explanation of this is given on page

Omissions

Omissions are negligible in the pair of problems not highly differentiated as to experience and far in excess for the unfamiliar situation in the other two pairs. Table XL gives for the total percentages, 5% omissions for the experienced situations and 21% omissions for the non-experienced situations.

Group D,--Easy Problems

Problems: 1 and 5; 9 and 7; 4 and 12.

Group D consists of three pairs of easy problems. Problem 1 is based on a situation judged to be experienced and is matched with problem 5 which is based on a situation judged to be non-experienced. Problem 9 is matched with problem 7, and problem 4 is matched with problem 12. These problems are listed on page 27. The tables in Group D are like those in Group A and are read in the same way. For explanation of these tables see page 43.

Table XLI.

Group D,--Easy Problems

Tabulation of One Thousand Solutions for Problem 1 in which the Situation is Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	89	0	1	10	0	0
	Not Experienced	10	0	0	0	0	0
	Total No.	99	0	1	10	0	0
	Per Cent	90%	0	.9%	9%	0	0
	Experienced: 90%	Right Process: 90%		Right Answers: 90%			
B 190	Experienced	162	0	1	14	1	1
	Not Experienced	10	0	0	1	0	0
	Total No.	172	0	1	15	1	1
	Per Cent	90%	0	.5%	8%	.5%	.5%
	Experienced: 94%	Right Process: 90%		Right Answers: 90%			
C 540	Experienced	417	0	2	46	1	0
	Not Experienced	66	0	2	6	0	0
	Total No.	483	0	4	52	1	0
	Per Cent	89%	0	.7%	9%	.2%	0
	Experienced: 86%	Right Process: 89%		Right Answers: 89%			
D 160	Experienced	113	0	3	16	0	0
	Not Experienced	22	0	0	6	0	0
	Total No.	135	0	3	22	0	0
	Per Cent	84%	0	2%	14%	0	0
	Experienced: 83%	Right Process: 84%		Right Answers: 84%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XLII.

Group D,--Easy Problems

Tabulation of One Thousand Solutions for Problem 5 in which the Situation is Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	0	0	0	0	0	0
	Not Experienced	104	0	6	0	0	0
	Total No.	104	0	6	0	0	0
	Per Cent	95%	0	5%	0	0	0
	Experienced: 0	Right Process: 95%		Right Answers: 95%			
B 190	Experienced	5	0	0	0	0	0
	Not Experienced	179	0	4	0	2	0
	Total No.	184	0	4	0	2	0
	Per Cent	97%	0	2%	0	1%	0
	Experienced: 3%	Right Process: 97%		Right Answers: 97%			
C 540	Experienced	8	0	3	0	0	0
	Not Experienced	459	0	63	0	7	0
	Total No.	467	0	66	0	7	0
	Per Cent	86%	0	12%	0	1%	0
	Experienced: 2%	Right Process: 86%		Right Answers: 86%			
D 160	Experienced	5	0	2	0	0	0
	Not Experienced	127,	0	25	0	1	0
	Total No.	132	0	27	0	1	0
	Per Cent	83%	0	16%	.0	.6%	0
	Experienced: 4%	Right Process: 83%		Right Answers: 83%			

*This percentage is based upon the number of right process selections.

See page 43 for explanation.

Table XLIII.

Group D,--Easy Problems

Comparison of Percentages as to Experience, Right Process, and Right Answer, for Problems 1 and 5.

IQ	Problem	Experience	Right Process	Right Answer
A	1	82%	90%	90%
110	5	0	95%	95%
B	1	94%	90%	90%
190	5	3%	97%	97%
C	1	86%	89%	89%
540	5	2%	86%	86%
D	1	70%	84%	84%
160	5	3%	83%	83%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XLIV.

Group D,--Easy Problems

Total Numbers and Percentages for Problems 1 and 5, Irrespective of IQ Groups.

Problem 1	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	889	889	0	9	99	2	1
Per Cent	89%	89%	0	.9%	10%	.2%	.1%

Problem 5	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	887	887	0	103	0	10	0
Per Cent	89%	89%	0	10%	0	1%	0

This table is read as follows: The upper table gives tabulations for problem 1 based on an experienced situation, and the lower table gives tabulations for problem 5, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XLI, XLII, XLIII, XLIV, for Problem 1 (Experienced) and Problem 5 (Non-experienced) in Group D,--Easy Problems.

These two problems judged as experienced and non-experienced from the activity study are found to be consistently so for all IQ groups as reported by the questionnaire. The lowest percentage experiencing the situation in problem 1 is 70% in group D, while the highest is 94% in group B. The lowest percentage experiencing the situation in problem 5 is 0% in group A, and the highest is 3% in both group D and group B. This is shown in Table XLIII.

The percentage of children experiencing or not experiencing these situations appears to show no consistent relation to the IQ.

The percentage of right answers is identical with the percentage of right process as there are no errors in computation in either problem. These percentages are very close for the two problems and are high. In the familiar situation the percentages are slightly lower for the A and B groups of IQ's but slightly higher for the C and D groups of IQ's. They tend to decrease with decreasing IQ's. Table XLIII shows percentages from 90% to 84% for right process and right answer in the experienced situation, and percentages from 97% to 83% for right process and right answer for the non-experienced situation. In Table XLIV, giving total percentages, right answer and right process have exactly the same percentage, 89% for both problems.

There are no errors in computation for either problem.

Selection of wrong process is more frequent in the unfamiliar situation. In problem 1 it is negligible, running from .9% to 2%. In problem 5 the lowest percentage of wrong process is 2% in group B and the highest is 16% in group D. They tend to increase with a

decreasing IQ. Total percentages as given in Table XLIV are .9% for the experienced situation as against 10% for the non-experienced situation.

There are no incomplete problems in problem 5, but problem 1 has the lowest percentage 8% in group B and the highest 14% in group D.

The percentage of problems omitted is slightly larger in the non-experienced problem but almost nil in both.

The excess of incomplete problems in problem 1 raises the question as to whether the easiness of the example plus the familiarity of the situation tends to foster a carelessness to think through the situation.

Summary of Findings in Tables XLI, XLII, XLIII, XLIV, for Problem 1 (Experienced) and Problem 5 (Non-experienced) in Group D,--Easy Problems.

We are justified in regarding the situation in problem 1 as an experienced one and that in problem 5 as a non-experienced one.

The percentage of children reporting a situation as experienced or non-experienced bears no consistent relation to the IQ.

The percentage of right answers and right processes are high and very close for the two problems. In the A and B groups of IQ's the unfamiliar situation shows slightly higher percentages and in the C and D, IQ groups the familiar situation shows slightly higher percentages. Total percentages, as in Table XLIV, are identical for the two problems.

These percentages tend to decrease with decreasing IQ's.

There are no errors in computation for either problem.

Selection of wrong process is more frequent in the unfamiliar situation and tends to increase with a decreasing IQ. In Table XLIV the experienced situation has .9% as against 10% in the non-experienced situation.

The familiar situation shows more incomplete problems, 10% as against 0% in the unfamiliar situation. (See Table LXIV.)

Omissions are slightly larger in the non-experienced situation, but very infrequent in both.

Table XLV.

Group D,--Easy Problems

Tabulation of One Thousand Solutions for Problem 9 in which the Situation is Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	* Errors Computation				
A 110	Experienced	36	0	0	0	1	0
	Not Experienced	72	0	0	0	1	0
	Total No.	108	0	0	0	2	0
	Per Cent	98%	0	0	0	2%	0
	Experienced: 34%	Right Process: 98%		Right Answers: 98%			
B 190	Experienced	62	4	0	0	2	0
	Not Experienced	119	2	0	0	0	1
	Total No.	181	6	0	0	2	1
	Per Cent	95%	3%	0	0	1%	.5%
	Experienced: 36%	Right Process: 98%		Right Answers: 95%			
C 540	Experienced	146	6	1	0	4	0
	Not Experienced	366	9	2	0	6	0
	Total No.	512	15	3	0	10	0
	Per Cent	95%	3%	.6%	0	2%	0
	Experienced: 29%	Right Process: 98%		Right Answers: 95%			
D 160	Experienced	42	1	0	0	0	0
	Not Experienced	108	6	1	0	2	0
	Total No.	150	7	1	0	2	0
	Per Cent	94%	4%	.6%	0	1%	0
	Experienced: 27%	Right Process: 98%		Right Answers: 94%			

*This percentage is based upon the number of right processes selected.

For exolanation see page 43.

Table XLVI.

Group D,--Easy Problems

Tabulation for One Thousand Solutions for Problem 7 in which the Situation is Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	13	0	0	0	0	0
	Not Experienced	96	1	0	0	0	0
	Total No.	109	1	0	0	0	0
	Per Cent	99%	.9%	0	0	0	0
	Experienced: 12% Right Process: 100% Right Answers: 99%						
B 190	Experienced	22	1	0	0	0	0
	Not Experienced	159	1	5	0	0	0
	Total No.	181	2	5	0	0	2
	Per Cent	95%	1%	3%	0	0	1%
	Experienced: 12% Right Process: 96% Right Answers: 95%						
C 540	Experienced	56	0	0	0	1	0
	Not Experienced	459	8	13	0	2	1
	Total No.	515	8	13	0	3	1
	Per Cent	96%	2%	2%	0	.6%	.2%
	Experienced: 10% Right Process: 97% Right Answers: 96%						
D 160	Experienced	21	0	0	0	0	0
	Not Experienced	132	1	5	0	1	0
	Total No.	153	1	5	0	1	0
	Per Cent	96%	.7%	3%	0	.6%	0
	Experienced: 13% Right Process: 97% Right Answers: 96%						

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table XLVII.

Group D,--Easy Problems

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 9 and 7.

IQ	Problem	Experience	Right Process	Right Answer
A	9	34%	98%	98%
110	7	12%	100%	99%
B	9	36%	98%	95%
190	7	12%	96%	95%
C	9	29%	98%	95%
540	7	10%	97%	96%
D	9	27%	98%	94%
160	7	13%	97%	96%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table XLVIII.

Group D,--Easy Problems

Total Numbers and Percentages for Problems 9 and 7, Irrespective of IQ Groups.

Problem 9	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	979	951	28	4	0	16	1
Per Cent	98%	95%	3%	.4%	0	2%	.1%

Problem 7	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	970	958	12	23	0	4	3
Per Cent	97%	96%	1%	2%	0	.4%	.3%

This table is read as follows: The upper table gives tabulations for problem 9 based on an experienced situation, and the lower table gives tabulations for problem 7, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XLV, XLVI, XLVII, XLVIII, for Problem 9 (Experienced) and Problem 7 (Non-experienced) in Group D,--Easy Problems.

The percentage of children reporting the situation in problem 9 as experienced is larger in every IQ group than that for problem 7. The difference is not, however, as marked as in most of the other problems. In problem 9 the highest percentage is 36% in group B and the lowest is 27% in group D. In problem 7 the highest percentage is 13% in group D and the lowest is 10% in group C. The form of the questions in the questionnaire may be a factor in this. For problem 9 we ask a specific question as to whether the child has ever baked cupcakes. In problem 7 we do not ask if the child has ever reckoned knots but only if he knows what a knot is. This probably tends to raise the percentage for problem 7, and lower it for problem 9. Another factor in number 9 is also that of being an activity more common to one sex which has entered into two other problems that have shown a decreased percentage of experience. In view of these facts we are probably justified in regarding these two problems as representing experienced and non-experienced situations respectively but to a less marked degree.

The percentage of children experiencing the situations tends on the whole to decrease with a decreasing IQ.

The percentage of right process is very close for the two problems and very high. The highest percentage in the unfamiliar situation is 100% in group A and the lowest is 96% in group B. In the familiar situation the percentage is 98% for all IQ groups. Total percentages in Table XLVIII are 98% for the experienced situation and 97% for the non-experienced situation.

Right answers also show a high and close percentage for both problems. The greatest difference is only two points in the lowest IQ group, where the unfamiliar situation has a percentage of 96% right answers and the familiar situation has 94% right answers. Percentages for the total numbers as shown in Table X.VIII are 95% for the experienced situation and 96% for the non-experienced situation.

Errors in computation are small in both problems but slightly in excess for the familiar situation. They tend to increase with a decreasing IQ. Table XLVIII shows 3% for the experienced situation as against 1% for the non-experienced situation.

Selection of wrong process shows a larger percentage in the unfamiliar situation but is not large in either case. This tends to increase with a decreasing IQ. Table XLVIII shows .4% for the experienced situation as against 2% for the non-experienced situation.

There are no incomplete problems.

Omissions are negligible but slightly larger for the familiar problem, 2% in the experienced situation as against .4% in the non-experienced situation as shown in Table XLVIII.

Summary of Findings in Tables XLV, XLVI, XLVII, XLVIII, for Problem 9 (Experienced) and Problem 7 (Non-experienced) in Group D,--Easy Problems.

These two problems may be regarded as experienced and non-experienced respectively, but to a less marked degree than most of the other problems. (See Table XLVII) Two factors enter into this, the form of the question in the questionnaire and the fact that one situation is more common to girls than to boys.

The percentage of children experiencing the situations tends to decrease with a decreasing IQ.

The percentages of right process and right answers is very close and very high for both problems in all IQ groups and the difference is negligible. Total percentages are 98% for the familiar situation and 97% for the unfamiliar situation in right processes selected and 95% for the familiar situation as against 96% for the unfamiliar situation in right answers. They show no particular relation to IQ groups.

Errors in computation are small in both problems but slightly in excess for the familiar situation. They tend to increase with a decreasing IQ. The experienced situation has 3% as against .4% in the non-experienced situation as shown in Table XLVIII.

Selection of wrong process shows a larger percentage in the unfamiliar situation but is not large in either problem. This tends to increase with a decreasing IQ. Table XLVIII shows .4% for the experienced situation as against 2% for the non-experienced situation.

There are no incomplete problems.

Omissions are negligible but slightly larger for the familiar problem, 2% in the experienced situation as against .4% in the non-experience d situation as shown in Table XLVIII.

Table XLIX.

Group D,--Easy Problems

Tabulation of One Thousand Solutions for Problem 4 in which the Situation is Judged Experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	100	0	0	0	0	0
	Not Experienced	10	0	0	0	0	0
	Total No.	110	0	0	0	0	0
	Per Cent	100%	0	0	0	0	0
	Experienced: 91%	Right Process: 100%		Right Answers: 100%			
B 190	Experienced	152	4	0	0	2	0
	Not Experienced	32	0	0	0	0	0
	Total No.	184	4	0	0	2	0
	Per Cent	97%	2%	0	0	1%	0
	Experienced: 83%	Right Process: 97%		Right Answers: 99%			
C 540	Experienced	471	18	2	0	2	0
	Not Experienced	44	3	0	0	0	0
	Total No.	515	21	2	0	2	0
	Per Cent	95%	4%	.4%	0	.4%	0
	Experienced: 92%	Right Process: 99%		Right Answers: 95%			
D 160	Experienced	140	7	1	0	1	0
	Not Experienced	9	0	2	0	0	0
	Total No.	149	7	3	0	1	0
	Per Cent	93%	5%	2%	0	.7%	0
	Experienced: 93%	Right Process: 97%		Right Answers: 93%			

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table L.

Group D,--Easy Problems

Tabulation of One Thousand Solutions for Problem 12 in which the Situation is Judged Non-experienced.

IQ		Right Process		Wrong Process	In-complete	Omit	?
		Right Answers	*Errors Computation				
A 110	Experienced	1	0	0	0	0	0
	Not Experienced	101	1	1	0	5	1
	Total No.	102	1	1	0	5	1
	Per Cent	93%	1%	.9%	0	5%	.9%
	Experienced: .9%	Right Process: 94%	Right Answers: 93%				
B 190	Experienced	1	0	0	0	0	0
	Not Experienced	165	3	9	0	6	6
	Total No.	166	3	9	0	6	6
	Per Cent	87%	2%	5%	0	3%	3%
	Experienced: .5%	Right Process: 89%	Right Answers: 87%				
C 540	Experienced	3	0	0	0	0	0
	Not Experienced	409	10	68	0	47	3
	Total No.	412	10	68	0	47	3
	Per Cent	76%	2%	13%	0	9%	.6%
	Experienced: .6%	Right Process: 78%	Right Answers: 76%				
D 160	Experienced	1	0	0	0	4	0
	Not Experienced	93	8	30	0	22	2
	Total No.	94	8	30	0	26	2
	Per Cent	59%	8%	19%	0	16%	1%
	Experienced: 3%	Right Process: 64%	Right Answers: 59%				

*This percentage is based upon the number of right process selections. See page 43 for explanation.

Table LI.

Group D,--Easy Problems

Comparison of Percentages as to Experience, Right Process, and Right Answer for Problems 4 and 12.

IQ	Problem	Experience	Right Process	Right Answer
A	4	91%	100%	100%
110	12	.9%	94%	93%
B	4	83%	97%	99%
190	12	.5%	89%	87%
C	4	92%	99%	95%
540	12	.6%	78%	76%
D	4	93%	97%	93%
160	12	3%	64%	59%

This table is read as follows: Beginning at the left, the first space is the IQ group with the number of cases involved. (See page 37) The next space is the number of the problem, the problem judged as experienced being given first, and that judged as non-experienced being given next. The next three spaces give the percentages for experience, right process, and right answer.

Table LII.

Group D,--Easy Problems

Total Numbers and Percentages for Problems 4 and 12 Irrespective of IQ Groups.

Problem 4	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	990	958	32	5	0	5	0
Per Cent	99%	96%	3%	.5%	0	.5%	0

Problem 12	Right Process	Right Answer	Errors in Computation	Wrong Process	Incomplete	Omitted	?
Number	796	774	22	108	0	84	12
Per Cent	80%	77%	3%	11%	0	8%	1%

This table is read as follows: The upper table gives tabulations for problem 4 based on an experienced situation, and the lower table gives tabulations for problem 12, based on a non-experienced situation. Omitting right answers and errors in computation, the numbers reading across total the number of cases,--1,000. Right answers plus errors in computation equal right process. The percentages are all based on the number of cases (1,000) with the exception of the errors in computation which are tabulated only where right process is selected and are based on the number in right process. Omitting right answer and errors in computation, the percentages should total 100% with the exception of fractions of per cents.

Interpretations of Tables XLIX, L, LI, LII, for Problem 4 (Experienced) and Problem 12 (Non-experienced) in Group D,--Easy Problems.

These two problems judged as experienced and non-experienced from the activity study are reported so consistently for all IQ groups. The highest percentage reporting the situation as experienced in problem 4 is 93% in group D and the lowest is 83% in group B. The highest percentage reporting the situation as experienced in problem 12 is 3% in group D and the lowest is .5% in group B.

The variation in these percentages shows no particular relation to the IQ groups.

The percentage of right process is fairly high for both problems but is noticeably larger in the familiar situation in all IQ groups. In Table LI the percentages for the experienced situation run from 100% to 97% in the experienced situation and from 94% to 64% in the non-experienced situation. Percentages for the total number as shown in Table LII are 99% for the experienced situation as against 80% for the non-experienced situation. These percentages decrease with a decreasing IQ.

The percentage of right answers is only slightly lower than that of right process and bears the same relation. Table LII shows 96% for the experienced situation as against 77% for the non-experienced situation.

The percentages of errors in computation are almost identical and small in number. They tend to increase with a decreasing IQ.

The percentage of wrong process is considerably larger in the unfamiliar situation. The highest percentage for this in problem 4 is 2% in group D, and the lowest percentage is 0% in groups A and B. In problem 12 the highest percentage is 19% in group D and the lowest

is .9% in group A. Table LII shows .5% for the experienced situation as against 11% for the non-experienced situation.

There are no incomplete problems.

Omissions show a larger percentage in the unfamiliar problem. The difference increases considerably in the lower IQ groups. In problem 4 the highest percentage is 1% in group B and the lowest is 0% in group A. In problem 12 the highest percentage is 16% in group D and the lowest is 3% in group B. Percentages for total numbers as shown in Table LII are .5% for the experienced situation as against 8% for the non-experienced situation.

Table LIII.

Total Numbers and Percentages for Group D,--Easy Problems Irrespective of Groupings Except Problems Based on Experienced Situations and Problems Based on Non-experienced Situations.

		Experienced Situation	Non-experienced Situation
Right Process	Number	2,858	2,653
	Per Cent	95%	88%
Right Answers	Number	2,787	2,619
	Per Cent	93%	87%
Errors in Computation	Number	60	34
	Per Cent	2%	1%
Wrong Process	Number	18	234
	Per Cent	.6%	8%
Incomplete	Number	99	0
	Per Cent	3%	0
Omitted	Number	23	98
	Per Cent	.8%	3%
?	Number	2	15
	Per Cent	.06%	.5%

This table is read exactly like Table XIV. See page 66 for explanation.

Summary of Findings in Tables XLIX, L, LI, LII, for Problem 4 (Experienced) and Problem 12 (Non-experienced) in Group D,--Easy Problems.

We are justified in regarding these two problems as experienced and non-experienced respectively.

The variation in the percentages of children experiencing these situations shows no particular relation to the IQ groups.

The percentage of right process and right answers is fairly high for both problems and is noticeably larger for the familiar situation in all IQ groups. These percentages decrease with a decreasing IQ. In the table for total numbers, Table LII, right answers have 96% in the experienced situation as against 77% in the non-experienced situation. Right process has 99% for the experienced situation as against 80% for the non-experienced situation.

The percentages of errors in computation are low and almost identical for the two problems, 3%.

The percentage of wrong process is considerably larger in the unfamiliar situation, 11% as against .5% for the familiar situation as shown in Table LII.

There are no incomplete problems.

Omissions show a larger percentage in the unfamiliar situation and the difference in percentages for the two problems is markedly increased in the lower IQ groups. Percentages for total omissions as shown in Table LII are .5% for the experienced situation as against 8% for the non-experienced situation.

General Summary for Group D,--Easy Problems

There are six problems in this group, three selected as representing an experienced situation and three as representing a non-experienced situation. Problems 1, 9, and 4 represent experienced situations and are matched with problems 5, 7, and 12, as representing non-experienced situations.

Experience

All three pairs of problems may be regarded as showing a difference as to experience as reported by the children's questionnaires. This difference is a marked one in two pairs of problems. Problem 1 shows percentages of experience from 94% to 70% as against 3% to 0% in problem 5. This is shown in Table XLIII. Problem 4 shows percentages of experience from 93% to 83% as against 3% to .5% in problem 12. This is shown in Table LI. In the other pair the difference is less marked. Problem 9 shows percentages of experience from 36% to 27% as against 13% to 10% in problem 7. This is shown in Table XLVII. This pair of problems has within it the factor of a situation common to girls, as well as a poor type of question in the questionnaire.

In two pairs of problems the variation in the percentage of children experiencing the situation shows no consistent relation to the IQ groups. In the other pair of problems the percentage tends to decrease with a decreasing IQ.

Right Process and Right Answer

In the percentages for totals, Table LIII, right process and right answer are higher in the experienced situation. Right process has 95% for the familiar situation as against 88% for the unfamiliar situation, while right answer has 93% for the familiar situation as against 87% for the

unfamiliar situation.

The relationship to experienced and non-experienced situation does not appear consistent in the separate pairs of problems. In one pair it was almost nil, in one pair noticeably larger for the experienced situation, and in one pair larger in the upper IQ groups for the unfamiliar situation and larger in the lower IQ groups for the familiar situation.

These percentages tend to decrease with a decreasing IQ.

Errors in Computation

Errors in computation were very infrequent in two pairs of problems, and absent in the third pair. When present they were almost identical in percentage in one pair of problems and slightly in excess for the familiar situation in the other pair. In percentages of total numbers for all Group D,--Table LIII, the experienced situation has a slightly larger percentage, 2% as against 1% in the non-experienced situation.

Wrong Process

Selection of wrong process shows a larger percentage for the unfamiliar situation in all three pairs of problems and tends to increase with a decreasing IQ. In the total percentages as shown in Table LIII, the experienced situation has .6% as against 8% for the non-experienced situation.

Incomplete Problems

In two pairs of problems there are no incomplete problems. In the other pair there are more incomplete problems in the familiar situation. In the percentage of total numbers, Table LIII, the experienced situation has 3% as against 0% in the non-experienced situation.

Omissions

In Table LIII, percentages for total numbers, omissions were larger

for the non-experienced situation, 3% as against .8% for the experienced situation. In the separate problems they varied. They were slightly larger for the familiar situation in one pair, infrequent but slightly larger in the unfamiliar situation in another pair, and more frequent in the unfamiliar situation especially in the lower IQ groups in the third pair.

Table LIV.

Total Numbers and Percentages for the Twenty-four Thousand Solutions given to Twenty-four Problems, Twelve of which are Based on Experienced Situations, and Twelve of which are Based on Non-experienced Situations.

		Experienced Situation	Non-experienced Situation
Right Process	Number	9,754	7,542
	Per Cent	81%	63%
Right Answers	Number	8,115	6,629
	Per Cent	68%	55%
Errors in Computation	Number	1,639	913
	Per Cent	17%	12%
Wrong Process	Number	1,538	2,243
	Per Cent	13%	19%
Incomplete	Number	132	571
	Per Cent	1%	5%
Omitted	Number	473	1,568
	Per Cent	4%	13%
?	Number	103	76
	Per Cent	.9%	.06%

Explanation of this table is on the following page.

Table LIV gives the numbers and percentages for the twenty-four thousand solutions given to the twenty-four problems by one thousand children. This table is made irrespective of any grouping as to fractions, decimals, denominate numbers, or easy problems, and of any IQ grouping. The answers to the problems based on experience are tabulated separately from those based on non-experience, and they are listed as right process, right answers, errors in computation, wrong process, incomplete, omitted, and a few, where it was impossible to determine what had been done, as indeterminate.

The table is read as follows: Beginning at the left and reading toward the right, the first space indicates the tabulation as right process, right answer, errors in computation, wrong process, incomplete, omitted, or indeterminate. The next space indicates the line upon which to find the number and the percentage. The next space gives the number and the percentage for the various tabulations of the answers to problems based on an experienced situation. The last space gives the number and the percentage for the various tabulations of the answers to problems based on a non-experienced situation.

All percentages with the exception of errors in computation are based on 12,000, the number of solutions in each of the experienced and non-experienced groups. Errors in computation are tabulated only when right process was selected and are therefore based on the number of right processes selected. Right answers plus errors in computation equal right process. Omitting right answers and errors in computation, the numbers given under experienced situations and non-experienced situations should each total 12,000. Omitting right answers and errors in computation, the percentages given under experienced situations and non-experienced situations should total 100% with the exception of fractions of per cents.

Summary Based on Twelve Pairs of Problems

There are twenty-four problems in all, twelve selected as representing an experienced situation and twelve as representing a non-experienced situation. These problems are of four types: decimals, fractions, denominate numbers, and easy problems, and are designated respectively as A, B, C, D groups. The results of each problem as done by one thousand children are also grouped into four IQ groups which have letter ratings, A, B, C, D, the highest being A.

Experience

From the questionnaire answered by the children who did the problems, all twelve pairs of problems show a differentiation as to experience consistent with the initial selection.

In each of the four groups of problems there are two pairs which show a markedly high differentiation and one pair that is not so high. Thus we have eight pairs of problems showing high differentiation as to experience and four showing some differentiation but not so high.

In the A group of problems there appears no apparent factor influencing the matter of experience for the poorly differentiated problems and we may say that they are probably poorly selected. In the other three groups of problems the pair of problems showing a low differentiation each contain, in the problem representing an experienced situation, the factor of an activity which is common mainly to one sex. This, of course, lowers the percentage but tends to substantiate the validity of the questionnaire. In the group of easy problems, the pair of problems showing a smaller differentiation has also within it the factor of poorly worded questions in the questionnaire.

The percentage of children experiencing a problem shows no consistent variation with varying IQ groups. In eleven pairs of problems the

difference was almost nil or showing no relation. In one pair the percentages experiencing the situations decreased with a decreasing IQ.

Right Process

In the matter of right process and right answers groups A, B, and C show similar results while the group of easy problems differs from them. In groups A, B, and C the two pairs of problems in each group which showed a high differentiation as to experience show also a marked difference as to percentage of right processes selected and right answers achieved. In every case in these nine problems the selection of right process and the number of right answers is far in excess in the problem involving an experienced situation.

In the three pairs of problems in groups A, B, and C where the difference in percentage of experience is low, the selection of right process and achievement of right answers tends on the whole to occur slightly more often in the situation involving an unfamiliar situation. These percentages are, however, noticeably close, in two cases being high for each problem in the pair and in the other case low for each problem in the pair.

In the group of easy problems the percentages of selection of right process and of achievement of right answers show no consistent relation to the familiar or unfamiliar situation. The percentages were high in all problem groups and very close for the matched pairs of problems.

In all cases the percentage of right answers and right processes tends to decrease with a decreasing IQ.

Total percentages of right processes and right answers are higher for the problems based on experienced situations. Table LIV shows 81% right process and 68% right answers in the experienced situation as against 63% right process and 55% right answer in the non-experienced situation.

Errors in Computation

All errors in computation were tabulated only when right process was selected, and the percentage of errors is based on the number of right processes selected in each case.

On the whole the percentages of errors in computation tend to increase with a decreasing IQ.

There seems to be no general tendency in errors in computation in regard to experienced and non-experienced situations.

In group A,--Decimals, the percentage for the total numbers is higher for the problems based on experienced situations. Analyzing the separate problems we find that in the two problems which are more highly differentiated as to experience the percentage of errors is higher for the experienced situation, while in the other pair of problems the percentage of errors is close but slightly larger for the non-experienced situation.

In group B,--Fractions, the percentage of errors is consistently higher for the experienced situation in all three pairs of problems, as well as in the total percentage. Two of the pairs, however, show a very small difference while the third pair which is poorly matched for difficulty shows a larger difference.

In group C,--Denominate Numbers, the percentage for the total numbers is very close for the experienced and non-experienced situations, but slightly larger for the experienced situation. Unlike group A the two pairs of problems showing the highest difference in experience have higher percentages of errors in computation in the non-experienced situations. In the other pair of problems where the difference in percentage of experience is less the percentage of errors is very close but slightly in excess for the experienced situation.

In group D,--Easy Problems, errors in computation are either absent or very infrequent. When present they are slightly more frequent in the

experienced situation.

Percentages for total numbers of all problems as shown in Table LIV gives 17% errors in computation for the experienced situation as against 12% for the non-experienced situation.

Selection of Wrong Process.

There seems to be a general tendency to select the wrong process in an unfamiliar situation. In group D, all three pairs of problems showed a higher percentage of wrong processes selected in the unfamiliar situation. In group C, the two pairs which showed the highest difference as to experience had the larger percentage of wrong processes in the unfamiliar situation. Group B had two pairs of problems which had the larger percentage of wrong processes in the unfamiliar situation. The third pair in this group was not well matched for difficulty and the difference in percentage of wrong process was negligible. In group A one of the pairs of problems showing a marked difference in experience had a larger percentage of wrong processes in the unfamiliar situation, and the other had a negligible difference in percentages of wrong processes. In the other pair of problems where the difference in experience was not so great the higher percentage of wrong processes was in the familiar situation.

Eight pairs of problems out of the twelve showed a larger selection of wrong processes in the unfamiliar situation. These same pairs of problems usually showed a large difference in the percentages of experience also.

Total percentages of selection of wrong processes show a higher percentage for problems based on a non-experienced situation. Table LIV shows 13% for wrong process in the experienced situation as against 19% in the non-experienced situation.

Incomplete

Incomplete problems appear to any extent only where there are two step problems. In these problems where incomplete operations occur the tendency seems to be for the unfamiliar situation to show a larger percentage. Of the four pairs of two step problems three show an increase in percentage for the unfamiliar situation and the other had negligible results.

Percentages of total numbers as shown in Table LIV give 1% for incomplete problems in the experienced situation as against 5% in the non-experienced situation.

Omissions

Omissions in the A, B, and C groups of problems are far in excess in the unfamiliar situations. In the A group the larger percentage of omissions are almost entirely confined to the unfamiliar situations. In the B group the larger percentages of omissions are entirely in the unfamiliar situation. In the C group the two pairs of problems in which there was a marked difference as to percentage of experience showed a higher percentage of omissions in the unfamiliar situation. The third pair in this group where the difference in experience was not marked shows a negligible difference as to percentage of omissions.

Total percentages for omission of problems are higher in the problems based on unfamiliar situations. Table LIV shows 4% for omissions in the experienced situation as against 13% in the non-experienced situation.

Part IV.

A More Critical Examination

In view of certain inequalities in difficulty of computation in some of the matched pairs of problems as shown in Table I, and in view of other inequalities noted in the various groups, it seems wise to examine results somewhat more critically than the inclusion of these inequalities allows us to do in our summaries made heretofore. We also wish to indicate to an extent, according to the PE of differences in percentages, the significance of the differences in percentages found in a few of the tables in order that we may feel that we are not basing our conclusions on differences in percentages which have no real meaning.

Table I, page 42 , a comparison of problems as to difficulty as shown by number correct when given as examples without the problem situation, has been selected for statistical procedure, as it represents a very fundamental equality or inequality of matched pairs.

Table LV, on the following page, gives the results of this statistical procedure. Since a difference to be significant must be three times its PE, it can be seen that four of these pairs of problems show differences in difficulty which are of enough significance to call them not well matched. These are pair 2, problems 6 and 2; pair 3, problems 3 and 8; pair 9, problems 14 and 19; and pair 10, problems 18 and 22. One of these is in decimals, one in fractions, and two in denominate numbers.

Table LV.

Showing the Significance of the Differences Between the Percentages of Correct Solutions for Computation Involved in Twelve Matched Pairs of Problems as Found in Table I, page 42. Percentages are Based on 100 Cases.

Pair	Problems	Per Cent Right	Difference in Per Cent	P. E. Difference	Ratio
1	1	95	.01	.021	.45
	5	94			
2	6	69	.13	.017	7.6
	2	82			
3	3	93	.07	.018	3.9
	8	100			
4	4	96	.02	.016	1.2
	12	98			
5	9	98	0	0	0
	7	98			
6	15	71	.09	.04	2.2
	10	80			
7	11	84	.06	.032	1.8
	16	90			
8	17	92	.01	.026	.38
	13	91			
9	14	50	.17	.046	3.7
	19	67			
10	18	83	.35	.042	8.3
	22	48			
11	24	82	.04	.036	1.1
	20	86			
12	21	79	.07	.041	1.7
	23	72			

Reading from left to right the columns give the number of each pair of problems, the number of each problem, the percentage of correct solutions, the difference in percentage for each pair of problems, the P. E. difference, and the ratio of the P. E. difference to the difference in percentage found by dividing the difference in percentage by the P. E. difference. The formulas used are found in the Edgerton-Patterson table of standard errors and of percentages.[1]

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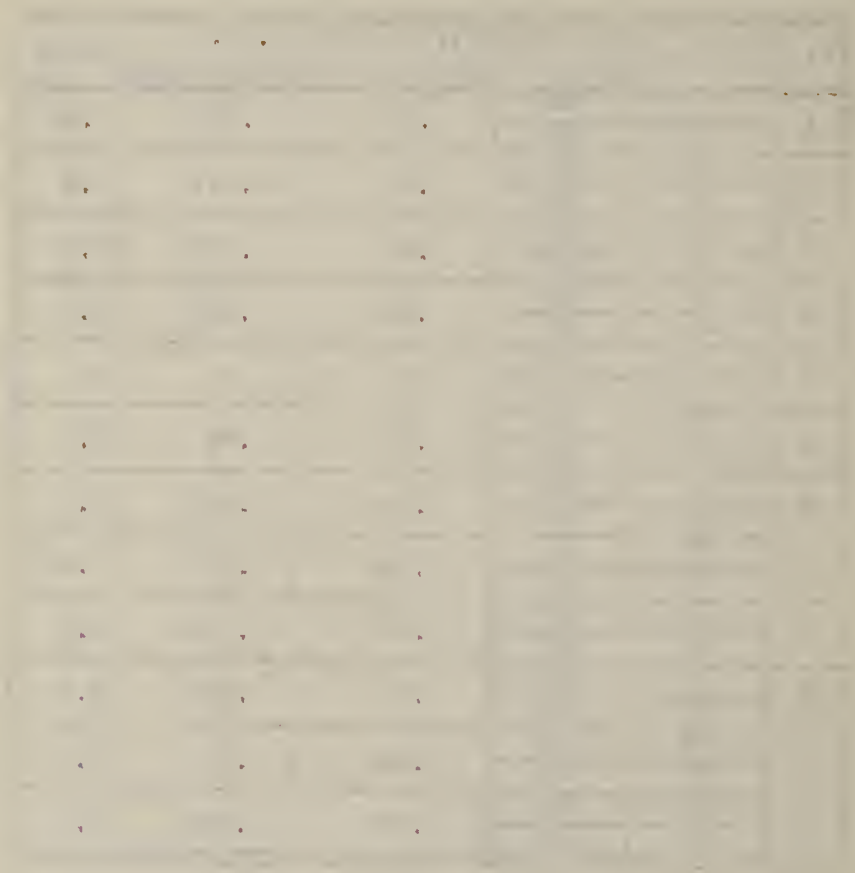
[1] H. A. Edgerton and . . Patterson, Journal of Applied Psychology, Vol. X, 1926. pp. 378-391.



This leaves us eight pairs of problems showing no significant differences in difficulty of computation. These eight pairs of problems arranged in order of equality of difficulty are as follows:

Pair	Problems
5	9 and 7
8	17 " 13
1	1 " 5
11	24 " 20
4	4 " 12
12	21 " 23
7	11 " 16
6	15 " 10

Of these eight pairs, 5, 8, and 7 did not show so high a differentiation as to experience as the other other five pairs. See pages 139, 76, 114. Discarding these, we have five pairs of problems which are highly differentiated as to experience and showing no significant differences in difficulty of computation. These pairs are as follows:

Pair	Problems
1	1 and 5
11	24 " 20
4	4 " 12
12	21 " 23
6	15 " 10

In the correction of 24,000 solutions to these problems certain tendencies to make similar errors in certain problems were noted and have seemed to indicate other inequalities in the matching of problems which may be noted as inequalities of word statement. These have

already been noted in the interpretations of various pairs of problems.

In problem 3 there was an excess of wrong processes selected, 32% as against 4% in problem 8. Children added when they should have subtracted. We cannot be sure why this was done, but it would seem possible that the arrangement of numbers might have some connection with this error. In problem 3, page 27, the smaller number comes first and may have tended to inhibit the idea of subtraction if there was any confusion as to process. The ratio of the PE difference to the difference in percentages of difficulty in computation also shows a significant difference so that this pair of problems might well be omitted in a critical examination.

In problem 10, page 27, the matter of "average" is introduced, while it is absent from the matched problem. This was purposely done as it developed in the study of frequencies of experience that children did not consider that they had experienced averaging although it was definitely taught as a process in arithmetic in their grade. It can, however, be considered as an inequality of word statement also, and while the results are illuminating as to the teaching of average, the unusually large percentage of incomplete solutions for this problem, 36% as against 2% for the matched problem, tends to make us consider it as one of the less equally matched problems. Discarding this pair from our list of five, as on page 162, we then have the following four problems left which we feel justified in saying show no significant differences in difficulty of computation and in inequality of word statement, and do show significant differences as to experience in the situations involved.

Pair	Problems
1	1 and 5
11	24 and 20
4	4 and 12
12	21 and 23

On the following pages are tables for each of these four pairs of problems, giving the percentages for the problems as based on experienced situations and on non-experienced situations, the difference in these percentages, the PE of the differences, and the significance as seen by the ratio of difference in percentage, and the PE of the difference. This is done for right process, right answer, errors in computation, wrong process, incomplete, omitted, and indeterminate solutions.

Table LVI.

Showing the Significance of the Differences in Percentages for Pair I, Problems 1 and 5.

	No. of Cases	Percentage of Solutions	Difference in Percentage	P. E. of Difference	Ratio
Right Process Experienced	1,000	.89	0	.009	0
Right Process Non-experienced	1,000	.89			
Right Answer Experienced	1,000	.89	0	.009	0
Right Answer Non-experienced	1,000	.89			
Errors in Computation Experienced	*889	.00	0	0	0
Errors in Computation Non-experienced	*887	.00			
Wrong Process Experienced	1,000	.009	.091	.006	15.1
Wrong Process Non-experienced	1,000	.10			
Incomplete Experienced	1,000	.10	.10	.006	1.6
Incomplete Non-experienced	1,000	.00			
Omitted Experienced	1,000	.002	.008	.002	4.0
Omitted Non-experienced	1,000	.01			
Indeterminate Experienced	1,000	.001	.001	0	0
Indeterminate Non-experienced	1,000	.00			

Reading from left to right the columns give the type of solution, the number of cases upon which the percentages are based, the percentages for experienced and non-experienced situations, the difference in these percentages, the P. E. of these differences, and the ratio of the P. E. difference to the percentage difference, giving the significance.

*Errors in computation are tabulated only where right process is selected and so are based on the number of right processes selected.

The formulas used are found in the Edgerton-Patterson table of Standard errors and probable error of percentages.

H. A. Edgerton and D. G. Patterson, Journal Applied Psychology, Vol. X, 1926. pp. 378-391.

Table LVII.

Showing the Significance of the Differences in Percentages for Pair 11, Problems 24 and 20.

	No. of Cases	Percentage of Solutions	Difference in Percentage	P. E. of Difference	Ratio
Right Process Experienced	1,000	.89	.17	.009	18.8
Right Process Non-experienced	1,000	.72			
Right Answer Experienced	1,000	.77	.11	.013	8.5
Right Answer Non-experienced	1,000	.66			
Errors in Computation Experienced	*891	.14	.06	.01	6.0
Errors in Computation Non-experienced	*723	.08			
Wrong Process Experienced	1,000	.07	.09	.009	9.9
Wrong Process Non-experienced	1,000	.16			
Incomplete Experienced	1,000	.00	.001	.00	.00
Incomplete Non-experienced	1,000	.001			
Omitted Experienced	1,000	.003	.107	.006	17.8
Omitted Non-experienced	1,000	.11			
Indeterminate Experienced	1,000	.04	.02	.005	4.0
Indeterminate Non-experienced	1,000	.02			

Reading from left to right the columns give the type of solution, the number of cases upon which the percentages are based, the percentages for experienced and non-experienced situations, the difference in these percentages, the P. E. of these differences, and the ratio of the P. E. difference to the percentage difference, giving the significance.

*Errors in computation are tabulated only where right process is selected and so are based on the number of right processes selected.

The formulas used are found in the Edgerton-Patterson table of standard errors and probable error of percentages.[1]

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[1] H. A. Edgerton and D. G. Patterson, Journal of Applied Psychology, Vol. X, 1926. pp. 378-391.

Table LVIII.

Showing the Significance of the Differences in Percentages for Pair 4, Problems 4 and 12.

	No. of Cases	Percentage of Solutions	Difference in Percentage	P. E. of Difference	Ratio
Right Process Experienced	1,000	.99	.19	.009	21.1
Right Process Non-experienced	1,000	.80			
Right Answer Experienced	1,000	.96	.19	.009	21.1
Right Answer Non-experienced	1,000	.77			
Errors in Computation Experienced	*990	.03	.00	.005	0
Errors in Computation Non-experienced	*796	.03			
Wrong Process Experienced	1,000	.005	.105	.002	52.5
Wrong Process Non-experienced	1,000	.11			
Incomplete Experienced	1,000	.00	.00	0	0
Incomplete Non-experienced	1,000	.00			
Omitted Experienced	1,000	.005	.075	.006	12.5
Omitted Non-experienced	1,000	.08			
Indeterminate Experienced	1,000	.00	.01	.002	5.0
Indeterminate Non-experienced	1,000	.01			

Reading from left to right the columns give the type of solution, the number of cases upon which the percentages are based, the percentages for experienced and non-experienced situations, the difference in these percentages, the P. E. of these differences, and the ratio of the P. E. difference to the percentage difference, giving the significance.

*Errors in computation are tabulated only where right process is selected and so are based on the number of right processes selected.

The formulas used are found in the Edgerton-Patterson table of standard errors and probable error of percentages.[1]

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[1] H. A. Edgerton and D. G. Patterson, Journal of Applied Psychology, Vol. X, 1926. pp. 378-391.

Table LIX.

Showing the Significance of the Differences in Percentages for Pair 12, Problems 21 and 23.

	No. of Cases	Percentage of Solutions	Difference in Percentage	P. E. of Difference	Ratio
Right Process Experienced	1,000	.92	.36	.017	21.1
Right Process Non-experienced	1,000	.56			
Right Answer Experienced	1,000	.58	.22	.014	15.7
Right Answer Non-experienced	1,000	.36			
Errors in Computation Experienced	*919	.37	.01	.017	.58
Errors in Computation Non-experienced	*562	.36			
Wrong Process Experienced	1,000	.02	.15	.008	18.7
Wrong Process Non-experienced	1,000	.17			
Incomplete Experienced	1,000	.002	.001	0	0
Incomplete Non-experienced	1,000	.001			
Omitted Experienced	1,000	.05	.21	.013	16.1
Omitted Non-experienced	1,000	.26			
Indeterminate Experienced	1,000	.004	.006	.002	3.0
Indeterminate Non-experienced	1,000	.01			

Reading from left to right the columns give the type of solution, the number of cases upon which the percentages are based, the percentages for experienced and non-experienced situations, the difference in these percentages, the P. E. of these differences, and the ratio of the P. E. difference to the percentage difference, giving the significance.

*Errors in computation are tabulated only where right process is selected and so are based on the number of right processes selected.

The formulas used are found in the Edgerton-Patterson table of standard errors and probable error of percentage.[1]

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[1] H. A. Edgerton and D. G. Patterson, Journal of Applied Psychology, Vol. X, 1926. pp. 378-391.

These problems show the same general tendencies as are found in the more inclusive summaries. With the exception of one of the easy pairs of problems, pair 1, the differences in percentages for right process are highly significant. For pairs 11, 4, and 12, these ratios were 18.8, 21.1, and 21.1. The differences in right answers were also highly significant for these three pairs of problems. The ratios for these were 8.5, 21.1, and 15.7. In pair 1, there were no differences in percentages of right process selected or of right answers, and there were no errors in computation. Errors in computation showed significant differences in percentages only in one pair of problems. Wrong process selected showed significant differences of percentages in all pairs of problems. Incomplete solutions showed no significant differences of percentages in all pairs of problems. Omissions showed significant differences of percentages in all four pairs of problems. Pair 1, did not show significant differences in the indeterminate group but the other three pairs showed a difference of significance, although not highly so as in the other differences.

Since differences in percentages do not always show the real significance, and the P. E. varies with the number upon which the percentages is based, two further tables have been prepared and are found in the following pages. Table LX gives the significance of the differences between the percentages for all problems based on experienced situations and non-experienced situations, as given in Table LIII, page 148. The second table, Table LXI, gives the significance of the differences in percentages for the selected group of eight problems as listed on page 164.

The percentages in Table LXI show a significant difference as a group as well as in the individual tables for these four pairs. Beyond these four pairs of problems we cannot be sure to what extent other factors or inequalities may influence the results. In comparing Table LX and LXI three main facts are noted. The indeterminate group in each case is apparently too small in number to show any significant differences. All other differences are significant but in the more critically selected group the differences of percentages are much more highly significant with the exception of errors in computation. Here the ratio comes within the area of significance but is much smaller. This is probably due to the fact that in selecting four more carefully controlled problems, some of the factors which led to errors in computation were eliminated.

The result of this more critical examination appears not to contradict findings in the summary for the twelve pairs of problems, but to sharpen the findings already made.

Table LX.

Showing the significance of the differences between the percentages for problems based on experienced situations and those for problems based on non-experienced situations, as found in Table LIII, page 148.

	No. of Cases	Percentage of Solutions	Difference in Percentage	P. E. of Difference	Ratio
Right Process Experienced	1,200	.81	.18	.012	15.
Right Process Non-experienced	1,200	.63			
Right Answer Experienced	1,200	.68	.13	.013	10.
Right Answer Non-experienced	1,200	.55			
Errors in Computation* Experienced	9,754	.17	.05	.003	16.6
Errors in Computation* Non-experienced	7,542	.12			
Wrong Process Experienced	1,200	.13	.06	.009	6.6
Wrong Process Non-experienced	1,200	.19			
Incomplete Experienced	1,200	.01	.04	.004	10.
Incomplete Non-experienced	1,200	.05			
Omitted Experienced	1,200	.04	.09	.004	22.5
Omitted Non-experienced	1,200	.13			
Indeterminate Experienced	1,200	.009	.0084	.00	0
Indeterminate Non-experienced	1,200	.0006			

Reading from left to right the column give the type of solution, the number of cases upon which the percentages are based, the percentages for experienced and non-experienced situations, the difference in these percentages, the P. E. of these differences, and the ratio of the P. E. difference to the percentage difference, giving the significance.

*Errors in computation are tabulated only where right process is selected and so are based on the number of right processes selected.

The formulas used are found in the Edgerton-Patterson table of standard errors and probable error of percentages.[1]

[1] H. A. Edgerton and D. G. Patterson, Journal of Applied Psychology, Vol. X, 1926. pp. 378-391.

Table LXI.

Showing the significance of the differences in percentages for the selected group of eight problems four of which are based on experienced situations and four of which are based on non-experienced situations. This group of problems is listed on page 164.

	No. of Cases	Percentage of Solutions	Difference in Percentage	P. E. of Difference	Ratio
Right Process Experienced	4,000	.92	.18	.005	36.0
Right Process Non-experienced	4,000	.74			
Right Answer Experienced	4,000	.80	.13	.006	21.6
Right Answer Non-experienced	4,000	.67			
Errors in Computation Experienced	*3,689	.13	.03	.005	6.0
Errors in Computation Non-experienced	*2,968	.10			
Wrong Process Experienced	4,000	.03	.10	.004	25.0
Wrong Process Non-experienced	4,000	.13			
Incomplete Experienced	4,000	.03	.0295	.002	14.7
Incomplete Non-experienced	4,000	.0005			
Omitted Experienced	4,000	.02	.09	.003	30.0
Omitted Non-experienced	4,000	.11			
Indeterminate Experienced	4,000	.01	.00	.002	0
Indeterminate Non-experienced	4,000	.01			

Reading from left to right the columns give the type of solution, the number of cases upon which the percentages are based, the percentages for experienced and non-experienced situations, the difference in these percentages, the P. E. of these differences, and the ratio of the P. E. difference to the percentage difference, giving the significance.

*Errors in computation are tabulated only where right process is selected and so are based on the number of right processes selected.

The formulas used are found in the Edgerton-Patterson table of standard errors and probable error of percentages.[1]

[1] H. A. Edgerton and D. G. Patterson, Journal of Applied Psychology, Vol. X, 1926. pp. 378-391.

Part V.--Conclusions

Implications for Education

I. Conclusions

1. From total percentages.

From the gross results of this study the following conclusions may be drawn:

(1) That a larger percentage of children select the right process in solving an arithmetic problem when the situation involved in that problem is based on the child's experience.

(2) That a larger percentage of children achieve the correct answer to a problem when the situation involved in that problem is based on the child's experience.

(3) That a larger percentage of children select the wrong process in solving an arithmetic problem when the situation involved in that problem is without the experience of the child.

(4) That when the right process is selected a slightly larger percentage of children make errors in computation when the problem is based on an experienced situation. This finding appears to be so inconsistent with the other findings that it would seem necessary to make a finer analysis of problems before accepting it as a final conclusion.

(5) That a larger percentage of children fail to complete a two step problem when the situation involved in that problem is not within the experience of the child.

(6) That a larger percentage of children fail to attempt the problem when the situation involved in that problem is not within the experience of the child.

Since too broad generalization and too unrefined results sometimes mislead or cover other factors which may counteract those results, we include also conclusions drawn from the analysis of various groups of problems, individual problems, and groups of IQ's. These conclusions follow.

2. From analysis of various groups and problems.

A. From the finer analysis which was made of the different groups of problems, pairs of individual problems, and IQ groups the following conclusions may be drawn:

(1) Where the problem is a very easy one for the child, the amount of experience which he may have had in the situation involved in the problem does not appear to be so large a factor in the selection of the right process or in the achievement of the right answer.

(2) Even in these easy problems, however, a lack of experience in the situation involved in the problem does appear to be a factor in the selection of wrong process.

(3) Errors in computation are much less where the problem is an easy one, but in the more difficult problems errors in computation seem to bear no particular relation to the problem as experienced or non-experienced, being higher in some cases and lower in others. It is probable that other factors than the matter of experience are more closely related to the percentage of errors.

(4) In two step problems, even where the problem is an easy one, a lack of experience in the situation involved in the problem appears to be a factor in not completing the problem.

(5) If problems are very easy they are seldom not attempted whether the situation be a familiar one or not.

(6) Experiences as used in these problems appear to be as universal with one range of intelligence as with another.

(7) There is a marked relation between the percentage of familiarity with a situation and the percentage of right answers and right processes. Where the differentiation between two problems as to familiarity of situation is great, the difference in percentages of right answers and right processes tends to be high. In the cases where the percentage of children experiencing the situation is low, due to an activity common to one sex, the percentage of right answers and right processes is correspondingly low.

(8) The intelligence of the child appears to be a factor in the amount of errors in computation and selection of wrong process as well as in right answers and selection of right processes. The higher I.Q's show fewer errors in computation and fewer wrong processes, but more right answers and more right processes.

B. From the critical evaluation of a selected group of four pairs of matched problems, the following conclusions may be drawn.

(1) Where the problem is a very easy one, the matter of experience or non-experience involved does not appear to be always so significant a factor in the selection of the right process or in the achievement of the right answer.

(2) In other problems the matter of experience in the situation involved in the problem is a highly significant factor in

(a) the selection of the right process
(b) the achievement of the right answer

(3) In other problems the matter of non-experience in the situation involved in the problem is a highly significant factor in

(a) selection of wrong process
(b) omissions of problems
(c) failing to complete the problem

(4) Errors in computation have a slightly larger percentage in the problems based on experience. The difference in percentage is significant but not nearly so for this selected group as for the more inclusive group of problems. This is due probably to the fact that many of the errors have other factors involved and that in eliminating some of the problems not well matched, certain of the factors causing errors were also eliminated.

(5) The results of the more critically evaluated group do not contradict the conclusions from our larger groups but tend to bring out the conclusions more sharply and to verify their significance.

The conclusions which we have drawn from the finer analysis of these problems do not appear to invalidate the earlier conclusions drawn from the gross results. They do, however, suggest that other factors beside the familiarity with the situation involved in the problem may also enter into the successful achievement of the problem.

3. Further possible factors involved.

Certain peculiarities of results in some of the individual problems point to other possible factors but do not, of course, give us enough data upon which to base conclusions. It does not seem amiss, however, to mention some of these as being worthy of further study.

(1) How effective is drill in problems based on unfamiliar situations?

Note results of problem 10 (average) and problem 22 (perimeter) both definitely taught in grade 6B. (pages 50 and 105)

(2) How much difference does the order and arrangement of the numerals used in the problem affect the successful solution of the problem?

Note the result and interpretation of problems 3 and 8. (page 64)

(3) How much does familiarity with the wording of a problem or drill in a problem even if involving an unfamiliar situation affect the success in its solution?

Note problem 2 and its interpretation. (page 92)

Implications for Education

We have in our introduction already noted the importance of investigation of failures in problem solving in arithmetic. Such investigations are of no value unless they have for us certain implications either in the way of materials or methods which will tend to direct the mental processes of children in such a way as to build habits of success. Materials are basic in their importance, the best of methods cannot present efficiently materials which are not within the child's comprehension. This brings us to the question of what kind of problems shall we give to children?

This study seems to show that experience in a situation involved in an arithmetic problem is an important factor in the selection of the right arithmetical process and in the achievement of the right answer. It also tends to show that unfamiliarity with the situation involved in the problem results in selection of a wrong process, failure to attempt the problem, and in lack of completion of two step problems. These findings should be of significance to the text book makers. How many of the problems in our text books are based on children's activities and experiences? If in analyzing text books we find 6,000 situations represented in the problems given, can we expect that any great percentage of these are truly based on children's experiences?

The question may be asked as to how possible it is to find universal experiences upon which to base problems. The consistency, in general, of the questionnaire in this study would tend to show that problems can be based on fairly universal experiences. To be objective, however, this data should be gathered from the activities of children and not solely from the judgment or imagination of adults.

The fact that in the group of easy problems the familiarity of the situation was not so great a factor in the selection of right process and in right answers has also its significance. This study does not present any objective explanations of this fact but it is possible to make some psychological inferences. Just what constitutes "easiness" in a problem may be difficult to say. One factor, at least, is probably that of small numbers. It would seem psychologically correct to assume that a longer association and experience with small numbers has allowed these concepts to become more free from reference to concrete objects. Brownell and Stretch[1] make this statement: "Among the most remarkable features of mature, expert performance in arithmetic is that of the freedom with which the number concepts are employed. . . . The adult number concepts require nothing of the concrete to make them meaningful and to permit him to manipulate them in a manner prescribed by the problem." Children arrive at this maturity in dealing with numbers slowly, and naturally begin with the more simple concepts. This explanation is consistent with the high percentage of correct answers and right processes found in the unfamiliar situations in the group of easy problems.

The significance of this for education is that in easy problems it is less necessary to confine the problems to the experienced situation as the child has reached a maturity of concept where this is not so great a factor in failure. This emphasizes the fact that until this maturity of concept is reached problems should be based on experience. Is this what we do? If we pick up almost any text book in arithmetic and read the easy problems and the harder problems, it would seem that we do just the opposite. The easy problems often seem childlike in their experience

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[1] W. A. Brownell and L. B. Stretch, The Effect of Unfamiliar Settings on Problem Solving, p. 84.

and the harder ones partake to a greater degree of adult experience. This is consistent with the innate nature of the problem but topsy-turvy for the learning of the child. It is possible we should consider the child more and the problem less.

The objective evidence of this study tends to emphasize the importance of basing our problems, with the exception of the easy ones at least, on situations which children have experienced. This is of greatest significance for our text books but there are also other questions which arise which need further study.

In the matter of curriculum how necessary and how effective as to real learning is the teaching of perimeter, for instance? Do we need some curriculum revision as well as text book analysis?

In the field of method, how effective is drill in problems based on unfamiliar situations?

If we first define our objectives and outcomes in problem solving, and then present problems which are consistent with a successful and efficient progress toward these outcomes, we can then afford to turn to the minor confusions and poor mental processes of the individual child. It is wasteful, however, to do this while still presenting poor material which breeds the very confusions that we are striving to eliminate.

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Note: See other references in footnotes in Part I of this thesis, pp.1-14.

Appendix A.

Directions for Administering the Test

Read the following directions to the children before passing out the papers:

"You are to be given a number of arithmetic problems. There will be time enough for almost everybody to finish all the problems. You are to work at your usual speed. If anyone finishes before the time is up, turn your paper face down and find something to do at your desk. Anyone who has not finished when the time is up is to draw a line across the page at the place where he stopped. Be sure and do all three pages."

* * * * * *

Pass out the tests.

Have children fill in the name, school, date, and age. The age can be given in years only, not months.

Ask the children to read the directions on the test sheet. Emphasize the fact that they are to use no other paper to figure on.

When this has been done have the children begin to work on the problems.

Allow 30 minutes for the test.

At the end of this time have the children who have not finished draw a line across the page where they have stopped.

Collect the papers and in the upper right hand corner place the IQ letter rating for each child.

On Wednesday have the children fill out the accompanying questionnaire.

Read the directions on this questionnaire to the children and then let them fill out the answers without suggestions.

The tests are not to be corrected, but will be called for on Thursday.

Please return unused extra tests and questionnaires.

Appendix B.

Problems in Arithmetic

Name..... School.....

Date..... Score..... Score².....

Age last birthday.....

Directions: Find the answers to as many of these problems as you can.
Use the space under each problem to figure on.
Do not use any other paper.
Write the answer on the answer lines.
Do not begin until you are told.

---

1. If you can buy two Yo-yo tops for 25¢, how many can you buy for 50? - Answer .....

2. Mrs. James bought a ham weighing $10\frac{1}{2}$ lbs. A few days later she weighed what was left of it and found that it weighed only 5 3/8 lbs. How much of the ham had she used? - - - - - - - - - - - - - - - Answer .....

3. The speedometer on our new car registered 86.7 miles when we started on a trip and 145.2 when we returned. Do you know how many miles we had driven? - Answer .....

4. There are 23 children belonging in our class, but only 19 are present. How many are absent? - - - - - - Answer .....

5. In paris you can buy 3 apples for 2 francs. How many apples can you buy for 4 francs? - - - - - - - - Answer .....

6. Ned weighs $69\frac{1}{2}$ lbs. and the height-weight chart says he should weigh $64\frac{3}{4}$ lbs. How many pounds overweight is he? - - - - - - - - - - - - - - - - - - Answer .....

7. A boat makes 15 knots an hour. How many knots can it make in three hours? - - - - - - - - - - - - - - Answer .....

8. If two automobiles started for Boston and one averaged 35.4 miles an hour, while the other averaged 24.5 miles an hour, how far apart would they be at the end of the hour? - - - - - - - - - - - - Answer .....

9. Jane can bake 12 cup cakes in a pan. How many can she bake in four pans? - - - - - - - - - - - - - - Answer .....

Fold this page back and do the next page.

Appendix B,--(continued)

10. A salesman traveled 125.9 miles the first day of a trip, 132.5 miles the second day, and 120.8 miles the third day. What was the average number of miles a day? - Answer .....

11. Joe made a running broad jump of 11 ft. 6 in., while Harry made 14 ft. 8 in. How much farther did Harry jump than Joe? - - - - - - - - - - - - - - - - Answer .....

12. A schilling in Austria is worth 14¢. If I exchange a quarter of a dollar for a schilling how much money will I lose? - - - - - - - - - - - - - - - - - - - Answer .....

13. A farmer planted 3/5 of his land to corn. Of this corn 5/6 was fodder corn. How much of his land was planted to fodder corn? - - - - - - - - - - - - - - - - Answer .....

14. Mary is 4 ft. 7 in. tall. Lena is 5 ft. 2 in. tall. How much taller is Lena than Mary? - - - - - - - - - - - Answer .....

15. John has saved $4.20 in a dime bank. In his school bank he has $17.23. His father says he will give him $10.00 more. How much more will John have to save to get $35.00 for camp? - - - - - - - - - - - - - - Answer .....

16. One farmer raised 100 bu. 3 pk. of potatoes and another farmer raised 75 bu. 2 pk. How much more did the first farmer raise? - - - - - - - - - - - - - - - Answer .....

17. A cake recipe that Marie was using called for $\frac{3}{4}$ cup of butter. Since Marie was taking only half the amounts called for, she needed only ..... of a cup of butter. - Answer .....

18. The measuring rod shows that John is 63 inches tall. How many feet and inches tall is he? - - - - - - Answer .....

19. If it takes 14 ozs. of flour to make one loaf of bread, how many loaves can be made from 70 lbs? - - - - Answer .....

20. The German coin called the mark is worth $.25. How many marks can you get for $7.50? - - - - - - - - - - - Answer .....

21. Tom weighed $82\frac{3}{4}$ lbs. before he went to camp. After he returned he weighed $89\frac{1}{4}$ lbs. He gained ..... lbs. while he was in camp. - - - - - - - - - - - - - - - - - - Answer .....

22. If a square meadow measures 6 rods on one side, how many feet are there in its perimeter? - - - - - - - - - Answer .....

23. A freight agent was unpacking boxes from a car, using a hand truck weighing $36\frac{3}{4}$ lbs. He was recording the weight of each box. One box and the truck weighed $84\frac{1}{4}$ lbs.; so he wrote down .... as the weight of that box. - - - - - - - - - - - - - - - - - - - Answer .....

Appendix B,--(continued)

24. Donald wants to buy a winter coat that costs $7.50. He can earn 50¢ every time he shovels snow on a sidewalk. How many sidewalks will he have to shovel to earn the money for his coat? - - - - - - - - - - - - - - Answer .....

Turn your paper face down and find something to do at your desk.

Appendix C.

Name..... School.....

Date.....

Some Questions to be Thought About

Read the following questions carefully and answer each one as honestly as you can. We do not care whether you answer yes or no as long as the answer is an honest one. Pay no attention to what your neighbor writes. We wish to know about YOU.

Each of the following questions will ask you if you have ever done something. If you have done this thing several times will you write YES, if you have never done it or done it very seldom will you write NO. If you are not quite sure whether you have done it enough times to write YES, or few enough times to write NO, you may put a ? for an answer. We hope that almost everyone will be able to write either YES or NO to the questions. Write the answers on the dotted lines.

Questions

1. Have you ever bought a Yo-yo top?- - - - - - - - - - - - - - .....
2. Did you ever weigh a ham?- - - - - - - - - - - - - - - - - - .....
3. Have you ever read the speedometer on an automobile? - - - - .....
4. Do you know how many children belong in your room? - - - - - .....
5. Have you ever used a franc? - - - - - - - - - - - - - - - - .....
6. Have you ever weighed yourself to see if you have gained? - .....
7. Do you know how far a knot is? - - - - - - - - - - - - - - - .....
8. Do you ever reckon how far apart automobiles are? - - - - - .....
9. Did you ever bake cup cakes in a pan? - - - - - - - - - - - - .....
10. Did you ever reckon the average mileage per day of a car? - .....
11. Do you know about how far a good running jump is? - - - - - .....
12. Have you ever used an Austrian schilling? - - - - - - - - - .....
13. Did you ever plant a field of corn? - - - - - - - - - - - - .....
14. Have you ever measured to see how tall you are? - - - - - - .....
15. Have you ever saved money for anything? - - - - - - - - - - .....
16. Have you ever raised a field of potatoes? - - - - - - - - - .....
17. Have you ever measured the quantities for making a cake? - - .....
18. Have you ever made a dozen loaves of bread? - - - - - - - - .....
19. Have you ever used a German mark? - - - - - - - - - - - - - .....
20. Have you ever measured land? - - - - - - - - - - - - - - - - .....
21. Did you ever weigh boxes on a truck? - - - - - - - - - - - - .....
22. Did you ever earn money for anything? - - - - - - - - - - - .....

Appendix D.

Name..... School..... Date.....

(1) $25\overline{)50}$

$2 \times 2 =$

(2) $10\frac{1}{2}$
-5

(3) 145.2
-86.7

(4) 23
-19

(5) $4 \div 2 =$

$2 \times 3 =$

(6) $69\frac{1}{2}$
$-64\frac{3}{4}$

(7) 15
$\times 3$

(8) 35.4
-24.5

(9) 12
$\times 4$

(10) Add 125.9
132.5
120.8

(11) 14 ft. 8 in.
-11 ft. 6 in.

(12) 25
-14

$3\overline{)379.2}$

(13) $\frac{5}{6} \times \frac{3}{5} =$

(14) 5 ft. 2 in.
-4 ft. 7 in.

(15) Add $\$ 4.20$
17.23
10.00

$\$35.00$
$- 31.43$

(16) 100 bu. 3 pk.
-75 bu. 2 pk.

(17) $\frac{1}{2} \times \frac{3}{4} =$

(18) $63 \div 12 =$

(19) 16
$\times 70$

(20) $25\overline{)7.50}$

(21) $89\frac{1}{4}$
$-82\frac{3}{4}$

$14\overline{)1,120}$

(22) $16\frac{1}{2}$
$\times 6$

(23) $84\frac{1}{4}$
$-36\frac{3}{4}$

(24) $50\overline{)7.50}$

99
$\times 4$

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1 1719 02574 6662